

REPORT DOCUMENTATION PAGE

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This volume provides information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) Program to Congressional Committees during the Fiscal Year 1982 hearing. This information is in addi- tion to the testimony given by DOD witnesses.					

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A Descriptive Summary is provided for each program element within the USAF FY 1982 RDT&E Program. Also included are Descriptive Summaries of projects requiring \$5 million or more within an element in FY 1982. A Test and Evaluation section is provided for major weapon systems.

The formats and contents of this document are in accordance with the guidelines and requirements of the Congressional Committees insofar as possible. The RDT&E funding information contained in the Descriptive Summaries is consistent with data contained in a separate document entitled, "Justification of Estimates for Fiscal Year 1982 RDT&E, AF."

The "RESOURCES" portion of the Descriptive Summaries includes, in addition to RDT&E funds, procurement funds and quantities, Military Construction Appropriation funds on specific development programs, and, where applicable, Department of Energy (DOE) costs.

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14 RDXM-DS-82-1

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**DEPARTMENT OF THE
AIR FORCE
SUPPORTING DATA FOR FISCAL YEAR 1982
BUDGET ESTIMATES**

SUBMITTED TO CONGRESS JANUARY 1981.



APPROVED FOR PUBLIC RELEASE:
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9) Final rept. FY 82.

11 Jan 82

DESCRIPTIVE SUMMARIES.

RESEARCH, DEVELOPMENT, TEST AND EVALUATION

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DESCRIPTIVE SUMMARIES FOR PROGRAM ELEMENTS OF
THE DEPARTMENT OF THE AIR FORCE RESEARCH AND DEVELOPMENT PROGRAM
FY 1982
JANUARY 1981

INTRODUCTION AND EXPLANATION OF CONTENTS

This document has been prepared to provide information on the United States Air Force (USAF) Research, Development, Test and Evaluation (RDT&E) Program to Congressional Committees during the Fiscal Year 1982 hearings. This information is in addition to the testimony given by DoD witnesses.

A Descriptive Summary is provided for each program element within the USAF FY 1982 RDT&E Program. Also included are Descriptive Summaries of projects requiring \$5 million or more within an element in FY 1982. A Test and Evaluation section is provided for major weapon systems.

The formats and contents of this document are in accordance with the guidelines and requirements of the Congressional Committees insofar as possible. The RDT&E funding information contained in the Descriptive Summaries is consistent with data contained in a separate document entitled, "Justification of Estimates for Fiscal Year 1982 RDT&E, AF," except where noted on the individual Descriptive Summaries.

The "RESOURCES" portion of the Descriptive Summaries includes, in addition to RDT&E funds, procurement funds and quantities, Military Construction Appropriation funds on specific development programs, Operation and Maintenance Appropriation funds where they are essential to the development effort described, and where appropriate, Department of Energy (DOE) costs.

- | Pages have been included to reflect changes as a result of the FY 1981 Supplemental and the FY 1982 Amendment.
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64220F	EF-111A.....	636
64222F	Nuclear Weapons Support.....	645
64223F	Alternate Fighter Engine.....	1109A
64226F	Long Range Combat Aircraft.....	368
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64231F	C-X Program.....	648
64247F	Modular Automated Test Equipment (MATE).....	304
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64312F	M-X.....	372
64314F	Advanced Medium Range Air-to-Air Missile.....	665
64321F	Joint Tactical Fusion Program.....	675
64361F	Air Launched Cruise Missile.....	382
64362F	Ground Launched Cruise Missile (GLCM).....	681
64406F	Space Defense System.....†	392
64411F	Space Shuttle.....	1114
64601F	Chemical/Biological Defense Equipment.....	689
64602F	Armament Ordnance Development.....	692
64604F	Low Altitude Airfield Attack System.....	697
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64706F	Life Support System.....	751
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64708F	Other Operational Equipment.....	757
64710F	Reconnaissance/Electronic Warfare Equipment.....	762
64711F	Systems Survivability.....	407
64715F	DOD Physical Security Equipment-Exterior.....	768
64724F	Tactical C ³ Countermeasures.....	771
64725F	Aircraft Identification Systems.....	777
64733F	Surface Defense Suppression.....	781
64735F	Improved Capability For Operational Test and Evaluation.....	1127
64737F	Airborne Self-Protection Jammer....	796
64738F	Protective Systems.....	805
64739F	Tactical Protective Systems.....	818
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64747F	Electromagnetic Radiation (EMR) Test Facilities.....	1133
64750F	Intelligence Equipment.....	855
64751F	Intra-Theatre Imaging System.....	862
64753F	Combat Helicopter Modernization.....	865
64754F	Joint Tactical Information Distribution System (JTIDS).....	869
64756F	Side Looking Airborne Radar.....	876
64758F	B-52 Companion Trainer Aircraft.....	415
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64779F	JINTACCS.....	890
65101F	Project Air Force.....	1137
65304F	Acquisition/Command Support (ACS) Telecommunication.....	1140
65306F	Environmental Epidemiology.....	1143
65708F	Aircraft Navigation System Verification.....	1031
65806F	Acquisition and Command Support.....	1146
65807F	Test and Evaluation Support.....	1163
65808F	Advanced Systems Engineering/Planning.....	1176
65890F	Installation Audiovisual Support.....	1180
65898F	Management Headquarters - R&D.....	1182
78019F	Utah Test and Training Range (UTTR).....	1208
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DEPARTMENT OF THE AIR FORCE

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

The reduction for inflation as a result of current economy measures being implemented by the present administration was applied to the following programs:

(\$ in Thousands)

PE NO.	TITLE	FY 81	FY 82
11113F	B-52 SQUADRONS	-223	-2746
11133F	SR-71 SQUADRONS	-18	-312
11142F	KC-135 SQUADRONS	-52	-573
11212F	TITAN SQUADRONS	-2	0
11213F	MINUTEMAN SQUADRONS	-118	-642
11312F	POST ATTACK CMD/CNTRL SYS	-15	-183
11316F	SAC COMMUNICATIONS	-51	-575
12311F	NORAD COC	-35	-460
12325F	JOINT SURVEILLANCE SYSTEM	-21	-28
12411F	SURVEILL RADAR STATIONS/SITES	-19	-84
12417F	CONUS OVER-THE-HORIZON RADAR	0	-414
12423F	BALLISTIC MSL EARLY WNG SYSTEM	-20	-249
12424F	SPACETRACK	-15	-156
12431F	DEFENSE SUPPORT PROGRAM	-161	-2714
12450F	SPACE DEFENSE OPS	-32	-21
27128F	F-4 SQUADRONS	-15	-122
27129F	F-111 SQUADRONS	-12	-53
27130F	F-15 SQUADRONS	-25	-474
27131F	A-10 SQUADRONS	-30	-179
27133F	F-16 SQUADRONS	-93	-821
27161F	TACTICAL AIM MISSILE	-8	0
27162F	TACTICAL AGM MISSILES	-18	0
27247F	TACTICAL SURVEILLANCE SYS	-1	-5
27252F	EF-111 SQUADRONS	-12	0
27411F	OVERSEAS AIR WEAPON CONT SYS	0	-44
27412F	TACTICAL AIR CONTROL SYSTEM	-27	-23
27415F	USAF COMMAND/CONTROL SYS	-14	0
27417F	TAC AIRBORNE CMD/CNTRL SYS	-139	-1028
27423F	ADV COMM SYS	-99	-969
27431F	TAC AIR INTELL SYS ACTYS	-6	-178
27591F	OMEGA	0	-362
28008F	AMRAAM OPER UTILITY EVAL	0	-61
28010F	JT TACTICAL COMM PROG (TRI-TAC)	-37	-556
31313F	DEFENSE DISSEMINATION SYSTEMS	-21	0
31314F	INFRARED PROCESSING + EXPLOIT	-7	-46
31315F	MISSILE AND SPACE TECH COLLECT	-36	-306
31317F	SENIOR YEAR OPERATIONS	-6	-36
31324F	FOREST GREEN	-34	-388
31357F	INTEG OPERATIONAL NUDETS DETECT	-27	-87

REDUCTION FOR INFLATION (Con't.)

PE NO.	TITLE	FY 81	FY 82
32010F	WMCCS ADP-AABNCP	-7	0
33110F	DEF SATELLITE COMM SYS	-74	-673
33126F	LONG-HAUL COMMUNICATIONS (DCS)	-25	-156
33131F	MINIMUM ESSENTIAL EMER COMM NETWORK	-30	-537
33144F	ELECTROMAG COMPATIBILITY ANAL CT	-13	-106
33401F	COMMUNICATIONS SECURITY	-2	-30
33601F	AIR FORCE SAT COMM SYS	-61	-1285
34111F	SPECIAL ACTIVITIES	0	0
35110F	SATELLITE CONTROL FACILITY	-31	-1327
35114F	TRAFFIC CNTRL/APPROACH/LANDING SYS	-7	-137
35119F	SPACE BOOSTERS	-65	-279
35130F	CONSOLIDATED SPACE OPERATIONS CE	-19	-360
35156F	SUPPORT PROGRAM	-15	-99
35158F	SATELLITE DATA SYSTEM	-96	-556
35160F	DEF METEOROLOGICAL SATELLITE PROG	-42	-922
35171F	SPACE LAUNCH SUPPORT	-8	-266
35887F	SIMULATOR VALIDATION (SIMVAL)	0	-27
35892F	SPECIAL ANALYSIS ACTYS	-111	-661
41119F	C-5 AIRLIFT SQUADRONS (IF)	-24	-304
61101F	IN-HOUSE LAB INDEPENDENT RESEARCH	-23	-220
61102F	DEFENSE RESEARCH SCIENCES	-262	-2669
62101F	GEOPHYSICS	-69	-337
62102F	MATERIALS	-83	-591
62201F	AEROSPACE FLIGHT DYNAMICS	-116	-578
62202F	AEROSPACE BIOTECHNOLOGY	-79	-530
62203F	AEROSPACE PROPULSION	-115	-769
62204F	AEROSPACE AVIONICS/VHSI CIRCUITS	-566	-775
62205F	TRAINING/SIMULATION TECH	-28	-230
62302F	ROCKET PROPULSION	-68	-509
62601F	ADVANCED WEAPONS	-582	-522
62602F	CONVENTIONAL MUNITIONS	-65	-407
62702F	COMMAND/CONTROL/COMMUNICATION	-636	-649
62703F	PERS UTILIZATION TECH	-11	-53
62704F	VERY HIGH SPEED INTEGRATED CIRC	-59	0
63101F	DEVELOPMENT PLANNING	0	-63
63202F	ACFT PROPULSION SUBSYS INTEGRAT	-30	-352
63203F	ADV AVIONICS FOR ACFT	-29	-332
63205F	FLT VEHICLE TECHNOLOGY	-17	-130
63208F	RECON SENSORS/PROCESSING TECH	-13	-80
63211F	AEROSPACE STRUCTURES/MATERIALS	-41	-360

REDUCTION FOR INFLATION (Con't.)

PE NO.	TITLE	FY 81	FY 82
63215F	AVIATION TURBINE FUEL TECHNOLOGY	-10	-75
63216F	ADV TURBINE ENGINE GAS GENERATOR	-58	-534
63227F	ADVANCED SIMULATOR DEVELOPMENT	-7	-42
63228F	NEXT GENERATION TRAINER ACFT	0	-286
63230F	ADVANCED TACTICAL FIGHTER	0	-197
63234F	ENFORCER	-13	0
63239F	ADV TACTICAL AIR RECONNAISSANCE	0	-59
63242F	COMBAT AIRCRAFT PROTOTYPE	0	-430
63244F	ACFT NON-NUCLEAR SURVIVABILITY	-3	-32
63245F	ADV FIGHTER TECH INTEGRATION	-23	-231
63246F	AIRCRAFT SUBSYSTEMS TECH	-12	0
63247F	MODULAR AUTOMATIC TEST EQ	-30	0
63249F	NIGHT ATTACK PROGRAM	-129	-59
63250F	LINCOLN LABORATORY	-48	-432
63253F	ADVANCED SYSTEM INTEGRATION DEMO	0	-132
63302F	ADV MSLE PROPULSION	-19	-134
63311F	ADV BALLISTIC RE-ENTRY SYS	-230	-955
63313F	ADV MSL SUBSYSTEMS DEMONSTRATION	-7	-115
63318F	COUNTER SUAVACS TECHNOLOGY PROG	-35	-203
63319F	ADVANCED TECHNOLOGY CRUISE MSL	-31	-275
63363F	HYPERVELOCITY MISSILE	0	-156
63370F	ADV MED RANGE A-A MSL	-54	-20
63401F	SPACE VEHICLE SUBSYSTEMS	-22	0
63402F	SPACE TEST PROGRAM	-91	-911
63424F	MSL SURVEILLANCE TECH	-27	-272
63425F	ADVANCED WARNING SYSTEMS	0	-240
63428F	SPACE SURVEILLANCE TECHNOLOGY	-87	-525
63429F	WARNING INFORMATION CORRELATION	-7	0
63431F	SPACE COMMUNICATIONS	-60	-984
63438F	SATELLITE SYS SURVIVABILITY	-70	-216
63439F	ADV SPACE APPLICATIONS PROGRAM	-2	0
63452F	VERY HIGH SPEED INTEGRATED CIRC	0	-792
63601F	CONVENTIONAL WEAPONS	-48	-5553
63605F	ADVANCED RADIATION TECH	-129	-1677
63609F	ADV ATTACK WEAPONS	-76	-1083
63616F	ADVANCED ASSAULT BREAKER DEV	-7	0
63703F	CONUS OVER-THE-HORIZON RADAR	-27	-84
63706F	HEARTLINE DEMONSTRATION PROG	-5	0
63707F	WEATHER SYSTEMS	-6	-25
63714F	DOD PHYSICAL SECURITY EQ-EXTER	-17	-19

REDUCTION FOR INFLATION (Con't.)

(\$ in Thousands)

PE NO.	TITLE	FY 81	FY 82
63718F	ELECTRONIC WARFARE TECHNOLOGY	-32	-229
63723F	CIVIL/ENVIRONMENTAL ENG TECH	-9	-76
63727F	ADVANCED COMMUNICATIONS TECH	-1	-103
63728F	ADVANCED COMPUTER TECHNOLOGY	-10	-94
63735F	MMCCS ARCHITECTURE	-15	-176
63739F	ADV DRONE/REMOTELY PILOTED VEH	-9	-55
63742F	TACTICAL IDENTIFICATION SYSTEM	-6	-153
63743F	ELECTRO-OPTICAL WARFARE	-25	-201
63745F	CHEMICAL WARFARE DEFENSE	0	-76
63746F	SIDE LOOKING AIRBORNE RADAR	-50	0
63747F	PAVE MOVER	-29	-101
63750F	COUNTER/COUNTERMEASURES	-15	-39
63751F	INNOVATIONS IN EDUCATION/TRAIN	-4	-50
63789F	COMD/CNTRL/COMM ADV DEV	-20	-296
63801F	SPECIAL PROGRAMS	-166	-633
64201F	ACFT AVIONICS EQUIPMENT DEVELOP	-46	-254
64211F	ADV AERIAL TARGETS DEV	-33	-317
64212F	AIRCRAFT EQUIPMENT DEV	-9	-42
64218F	ENGINE MODEL DERIVATIVE PROG	-151	-390
64219F	INTEGRATED DIGITAL AVIONICS	0	-41
64220F	EF-111A	0	-277
64222F	NUCLEAR WEAPONS SUPPORT	-3	-32
64226F	LONG RANGE COMBAT AIRCRAFT	-576	0
64227F	FLIGHT SIMULATOR DEVELOPMENT	-12	-145
64231F	C-X PROGRAM	-77	-5270
64247F	MODULAR AUTOMATIC TEST EQUIPMENT	0	-396
64249F	NIGHT PRECISION ATTACK	0	-1476
64268F	ACFT ENGINE COMPONENT IMPROVE	-233	-2205
64312F	M-X	-3301	-46007
64314F	ADV MED RANGE AIR-TO-AIR MSL	0	-2711
64321F	TACTICAL FUSION CENTERS	-12	-191
64361F	AIR LAUNCHED CRUISE MISSILE	-236	-1346
64362F	GRD LAUNCHED CRUISE MSL	-147	-11049
64406F	SPACE DEFENSE SYS	-244	-2814
64411F	SPACE SHUTTLE	-536	-5201
64601F	C/B DEFENSE EQUIPMENT	-15	-172
64602F	ARMAMENT ORDNANCE DEVELOPMENT	-44	-492
64607F	WIDE-AREA ANTI-ARMOR MUNITION	-42	-424
64608F	CLOSE AIR SUPPORT WEAPONS SYSTEM	-104	-284
64610F	AIR DELIVERED LAND MINES	-10	0

REDUCTION FOR INFLATION (Con't.)

PE NO.	TITLE	(\$ in Thousands)	
		FY 81	FY 82
64612F	LOW LEVEL LASER GUIDED BOMB	-11	-162
64614F	ADV CONVENTIONAL STAND-OFF MSL	0	-566
64616F	AIR-LAUNCHED ASSAULT BREAKER	0	-468
64706F	LIFE SUPPORT SYSTEM	-21	-214
64707F	WEATHER SYSTEMS	-8	-105
64708F	OTHER OPERATIONAL EQUIPMENT	-22	-256
64710F	RECONNAISSANCE EQUIPMENT	-33	-254
64711F	SYSTEMS SURVIVABILITY (NUC EFFECTS)	-31	-235
64715F	DOD PHYSICAL SECURITY EQ-EXTER	-44	-153
64724F	TAC C3 COUNTER-MEASURES	-22	-235
64725F	ACFT IDENTIFICATION SYSTEMS	-6	-96
64733F	SURFACE DEF SUPPRESSION	-20	-187
64735F	IMPROVED CAPABILITY FOR OTE	-28	-441
64737F	AIRBORNE SELF-PROTECTION JAWHER	-27	-1062
64738F	PROTECTIVE SYSTEMS	-118	-1666
64739F	TACTICAL PROTECTIVE SYSTEMS	-54	-464
64740F	APPL FOR INFO PROCESSING TECH	-10	-114
64742F	PRECISION LOCATION STRIKE SYSTEM	-33	-1588
64746F	EXPENDABLE DRONES	-12	-167
64747F	ELECTROMAG RADIATION TEST FACIL	-7	-61
64750F	INTELLIGENCE EQUIPMENT	-35	-288
64751F	INTRA-THEATRE IMAGING SYSTEM	-5	-9
64753F	COMBAT HELICOPTER MOD (H-X)	0	-368
64754F	JT TAC INFO DIST SYS	-132	-1673
64756F	SIDE LOOKING AIRBORNE RADAR (SLAR)	0	-568
64757F	SYSTEMS PROTECTION	-1	0
64758F	COMPANION TRAINER AIRCRAFT DEV	-27	-46
64778F	NAVSTAR GPS USER EQUIPMENT	-280	-3249
64779F	JT INTEROPERABILITY TAC COMD/CNT	-19	-145
65101F	PROJECT AIR FORCE	-28	-270
65304F	ACQ/COMD SPT - TELECOM	-10	-92
65306F	ENVIRONMENTAL EPIDEMIOLOGY	-4	-76
65708F	AIRCRAFT NAVIGATION SYS VERIF	-3	-32
65806F	ACQUISITION AND COMMAND SUPPORT	-506	-1421
65807F	TEST AND EVALUATION SPT	-722	-4175
65808F	ADV SYS ENGINEERING/PLAN	-9	-98
65890F	INSTL AUDIOVISUAL SPT (R/D)	-12	-107
65898F	MGT HQ (RESEARCH/DEV)	-44	-109
78019F	UTAH TESTING + TRAINING RANGE	-4	-229
78026F	PRODUCT/RELIABLE/AVAIL/MAINTAIN	-19	-179
01004F	INTERNATIONAL ACTIVITIES	-4	-25
TOTAL		-15,000	-155,000

DEPARTMENT OF THE AIR FORCE

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

Reduction for travel and other base operations support costs was applied to the following programs:

(\$ in Thousands)

PE NO.	TITLE	FY 81	FY 82
11113F	B-52 SQUADRONS	-189	0
11142F	KC-135 SQUADRONS	-34	0
11212F	TITAN SQUADRONS	-4	0
11213F	MINUTEMAN SQUADRONS	-33	0
11312F	POST ATTACK CMD/CNTRL SYS	-51	0
11316F	SAC COMMUNICATIONS	-11	0
12311F	NORAD COC	-11	0
12325F	JOINT SURVEILLANCE SYSTEM	-18	0
12411F	SURVEILL RADAR STATIONS/SITES	-7	0
12424F	SPACETRACK	-27	0
12431F	DEFENSE SUPPORT PROGRAM	-31	0
27128F	F-4 SQUADRONS	-10	0
27130F	F-15 SQUADRONS	-84	0
27131F	A-10 SQUADRONS	-84	0
27133F	F-16 SQUADRONS	-250	0
27252F	EF-111 SQUADRONS	-31	0
27412F	TACTICAL AIR CONTROL SYSTEM	-12	0
27415F	USAF COMMAND/CONTROL SYS	-11	0
27417F	TAC AIRBORNE CMD/CNTRL SYS	-111	0
27423F	ADV COMM SYS	-12	0
27431F	TAC AIR INTELL SYS ACTYS	-15	0
28010F	JT TACTICAL COMM PROG (TRI-TAC)	-51	0
31313F	DEFENSE DISSEMINATION SYSTEMS	-29	0
31315F	MISSILE AND SPACE TECH COLLECTION	-7	0
33110F	DEF SATELLITE COMM SYS	-32	0
33126F	LONG-HAUL COMMUNICATIONS (DCS)	-21	0
33131F	MINIMUM ESSENTIAL EMER COMM NETWORK	-18	0
33144F	ELECTROMAG COMPATIBILITY ANAL CTR	-16	0
33601F	AIR FORCE SAT COMM SYS	-44	0
34111F	SPECIAL ACTIVITIES	-176	0
35110F	SATELLITE CONTROL FACILITY	-3	0
35114F	TRAFFIC CNTRL/APPROACH/LANDING SYS	-25	0
35119F	SPACE BOOSTERS	-41	0
35160F	DEF METEOROLOGICAL SATELLITE PROG	-56	0
41119F	C-5 AIRLIFT SQUADRONS (IF)	-9	0
61102F	DEFENSE RESEARCH SCIENCES	-42	0
62101F	GEOPHYSICS	-55	0
62102F	MATERIALS	-77	0
62201F	AEROSPACE FLIGHT DYNAMICS	-84	0
62202F	AEROSPACE BIOTECHNOLOGY	-71	0
62203F	AEROSPACE PROPULSION	-64	0

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REDUCTION FOR TRAVEL (Con't.)

PE NO.	TITLE	(\$ in Thousands)	
		FY 81	FY 82
62204F	AEROSPACE AVIONICS/VHSI CIRCUITS	-177	0
62302F	ROCKET PROPULSION	-41	0
62601F	ADVANCED WEAPONS	-85	0
62602F	CONVENTIONAL MUNITIONS	-89	0
62702F	COMMAND/CONTROL/COMMUNICATION	-125	0
63202F	ACFT PROPULSION SUBSYS INTEG	-4	0
63203F	ADV AVIONICS FOR ACFT	-12	0
63205F	FLT VEHICLE TECHNOLOGY	-9	0
63208F	RECON SENSORS/PROCESSING TECH	-21	0
63211F	AEROSPACE STRUCTURES/MATERIALS	-24	0
63215F	AVIATION TURBINE FUEL TECHNOLOGY	-3	0
63216F	ADV TURBINE ENGINE GAS GENERATOR	-2	0
63244F	ACFT NON-NUCLEAR SURVIVABILITY	-4	0
63245F	ADV FIGHTER TECH INTEGRATION	-24	0
63246F	AIRCRAFT SUBSYSTEMS TECH	-3	0
63247F	MODULAR AUTOMATIC TEST EQ	-20	0
63249F	NIGHT ATTACK PROGRAM	-12	0
63302F	ADV MSLE PROPULSION	-4	0
63311F	ADV BALLISTIC RE-ENTRY SYS	-39	0
63318F	COUNTER SUAWACS TECHNOLOGY PROG	-15	0
63401F	SPACE VEHICLE SUBSYSTEMS	-8	0
63402F	SPACE TEST PROGRAM	-11	0
63424F	MSL SURVEILLANCE TECH	-18	0
63428F	SPACE SURVEILLANCE TECHNOLOGY	-28	0
63429F	WARNING INFORMATION CORRELATION	-2	0
63431F	SPACE COMMUNICATIONS	-19	0
63438F	SATELLITE SYS SURVIVABILITY	-12	0
63439F	ADV SPACE APPLICATIONS PROGRAM	-3	0
63605F	ADVANCED RADIATION TECH	-84	0
63703F	CONUS OVER-THE-HORIZON RADAR	-8	0
63708F	HEARTLINE DEMONSTRATION PROG	-7	0
63718F	ELECTRONIC WARFARE TECHNOLOGY	-10	0
63723F	CIVIL/ENVIRONMENTAL ENG TECH	-12	0
63727F	ADVANCED COMMUNICATIONS TECH	-2	0
63728F	ADVANCED COMPUTER TECHNOLOGY	-2	0
63735F	MMCCS ARCHITECTURE	-12	0
63739F	ADV DRONE/REMOTELY PILOTED VEH DE	-4	0
63742F	TACTICAL IDENTIFICATION SYSTEM	-14	0
63743F	ELECTRO-OPTICAL WARFARE	-8	0
63746F	SIDE LOOKING AIRBORNE RADAR	-19	0
63747F	PAVE MOVER	-10	0

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REDUCTION FOR TRAVEL (Con't.)

PE NO.	TITLE	(\$ in Thousands)	
		FY 81	FY 82
63750F	COUNTER/COUNTERMEASURES	-8	0
63789F	COMD/CNTRL/COMM ADV DEV	-12	0
64201F	ACFT AVIONICS EQUIPMENT DEVELOP	-44	0
64212F	AIRCRAFT EQUIPMENT DEV	-35	0
64218F	ENGINE MODEL DERIVATIVE PROG	-8	0
64222F	NUCLEAR WEAPONS SUPPORT	-14	0
64226F	LONG RANGE COMBAT AIRCRAFT	-160	0
64227F	FLIGHT SIMULATOR DEVELOPMENT	-79	0
64231F	C-X PROGRAM	-103	-50
64268F	ACFT ENGINE COMPONENT IMPROVE	-20	0
64312F	M-X	-291	-50
64361F	AIR LAUNCHED CRUISE MISSILE	-79	0
64406F	SPACE DEFENSE SYS	-25	0
64411F	SPACE SHUTTLE	-111	-50
64601F	C/B DEFENSE EQUIPMENT	-15	0
64602F	ARMAMENT ORDNANCE DEVELOPMENT	-6	0
64608F	CLOSE AIR SUPPORT WEAPONS SYSTEM	-36	0
64706F	LIFE SUPPORT SYSTEM	-27	0
64708F	OTHER OPERATIONAL EQUIPMENT	-32	0
64710F	RECONNAISSANCE EQUIPMENT	-12	0
64711F	SYSTEMS SURVIVABILITY (NUC EFFECTS)	-23	0
64715F	DOD PHYSICAL SECURITY EQ-EXTERIOR	-19	0
64724F	TAC C3 COUNTER-MEASURES	-7	0
64725F	ACFT IDENTIFICATION SYSTEMS	-11	0
64735F	IMPROVED CAPABILITY FOR OTE	-5	0
64738F	PROTECTIVE SYSTEMS	-60	0
64739F	TACTICAL PROTECTIVE SYSTEMS	-31	0
64740F	APPL FOR INFO PROCESSING TECH	-5	0
64742F	PRECISION LOCATION STRIKE SYSTEM	-37	0
64746F	EXPENDABLE DRONES	-14	0
64747F	ELECTRONAG RADIATION TEST FACIL	-7	0
64750F	INTELLIGENCE EQUIPMENT	-19	0
64754F	JT TAC INFO DIST SYS	-33	0
64778F	NAVSTAR GPS USER EQUIPMENT	-39	-50
64779F	JT INTEROPERABILITY TAC COMD/CNTR	-24	0
65807F	TEST AND EVALUATION SPT	-221	0
78026F	PRODUCT/RELIABLE/AVAIL/MAINTAIN	-20	0
01004F	INTERNATIONAL ACTIVITIES	-77	0
TOTAL		-4,700	-200

DEPARTMENT OF THE AIR FORCE

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

The reduction in civilian personnel and other base operations support costs was applied to the following programs:

PE NO.	TITLE	FY 81	FY 82
62101F	GEOPHYSICS	0	-120
62102F	MATERIALS	0	-100
62201F	AEROSPACE FLIGHT DYNAMICS	0	-200
62202F	AEROSPACE BIOTECHNOLOGY	0	-100
62203F	AEROSPACE PROPULSION	0	-100
62204F	AEROSPACE AVIONICS/VHSI CIRCUITS	0	-180
62302F	ROCKET PROPULSION	0	-50
62601F	ADVANCED WEAPONS	0	-220
62602F	CONVENTIONAL MUNITIONS	0	-60
62702F	COMMAND/CONTROL/COMMUNICATION	0	-270
65806F	ACQUISITION AND COMMAND SUPPORT	0	-1400
65807F	TEST AND EVALUATION SPT	0	-850
65898F	MGT HQ (RESEARCH/DEV)	0	-150
TOTAL		0	-3,800

The reduction in Management Headquarters for civilian personnel and realignment of functions was applied to the following program

PE NO.	TITLE	FY 81	FY 82
65898F	MGT HQ (RESEARCH/DEV)	0	-600

DEPARTMENT OF THE AIR FORCE

RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

The reduction in consulting services support was applied to the following programs:

PE NO.	TITLE	(\$ in Thousands)	
		FY 81	FY 82
11113F	B-52 SQUADRONS	-53	-494
11213F	MINUTEMAN SQUADRONS	-28	0
12431F	DEFENSE SUPPORT PROGRAM	-38	-488
27417F	TAC AIRBORNE COMD/CNTRL SYS	-33	-188
27423F	ADV COMM SYS	0	-175
33601F	AIR FORCE SAT COMM SYS	0	-225
36110F	SATELLITE CONTROL FACILITY	0	-238
61102F	DEFENSE RESEARCH SCIENCES	-61	-482
63249F	NIGHT ATTACK PROGRAM	-31	0
63431F	SPACE COMMUNICATIONS	0	-175
63605F	ADVANCED RADIATION TECH	-31	-282
63609F	ADV ATTACK WEAPONS	0	-194
64218F	ENGINE MODEL DERIVATIVE PROG	-38	0
64226F	LONG RANGE COMBAT AIRCRAFT	-138	0
64231F	C-X PROGRAM	0	-864
64249F	NIGHT PRECISION ATTACK	0	-263
64268F	ACFT ENGINE COMPONENT IMPROVE	-56	-451
64312F	M-X	-782	-8262
64314F	ADV MED RANGE AIR-TO-AIR MSL	0	-488
64361F	AIR LAUNCHED CRUISE MISSILE	-57	-238
64362F	GRD LAUNCHED CRUISE MSL	-35	-182
64406F	SPACE DEFENSE SYS	-58	-507
64411F	SPACE SHUTTLE	-128	-933
64737F	AIRBORNE SELF-PROTECTION JAMMER	0	-187
64738F	PROTECTIVE SYSTEMS	-28	-300
64742F	PRECISION LOCATION STRIKE SYSTEM	0	-282
64754F	JT TAC INFO DIST SYS	-31	-300
64778F	NAVSTAR GPS USER EQUIPMENT	-67	-582
65806F	ACQUISITION AND COMMAND SUPPORT	0	-219
65807F	TEST AND EVALUATION SPT	-109	-901
TOTAL		-1,800	-17,900

DEPARTMENT OF THE AIR FORCE
RESEARCH, DEVELOPMENT, TEST, AND EVALUATION

The reduction in productivity enhancements resulting from Capitol investments made in FY 1981 was applied to the following progrs.

		(\$ in Thousands)	
PE NO.	TITLE	FY 81	FY 82
11113F	B-52 SQUADRONS		-70
12431F	DEFENSE SUPPORT PROGRAM	0	-70
27417F	TAC AIRBORNE CMD/CNTRL SYS	0	-30
27423F	ADV COMM SYS	0	-30
33601F	AIR FORCE SAT COMM SYS	0	-30
35110F	SATELLITE CONTROL FACILITY	0	-30
61102F	DEFENSE RESEARCH SCIENCES	0	-70
63431F	SPACE COMMUNICATIONS	0	-30
63605F	ADVANCED RADIATION TECH	0	-40
63609F	ADV ATTACK WEAPONS	0	-30
84231F	C-X PROGRAM	0	-130
84249F	NIGHT PRECISION ATTACK	0	-40
84268F	ACFT ENGINE COMPONENT IMPROVE PROG	0	-70
84312F	M-X	0	-1180
84314F	ADV MED RANGE AIR-TO-AIR MSL	0	-70
84361F	AIR LAUNCHED CRUISE MISSILE	0	-40
84362F	GRD LAUNCHED CRUISE MSL	0	-30
84406F	SPACE DEFENSE SYS	0	-70
84411F	SPACE SHUTTLE	0	-140
84737F	AIRBORNE SELF-PROTECTION JAMMER	0	-30
84738F	PROTECTIVE SYSTEMS	0	-40
84742F	PRECISION LOCATION STRIKE SYSTEM	0	-40
84754F	JT TAC INFO DIST SYS	0	-40
84778F	NAVSTAR GPS USER EQUIPMENT	0	-90
65806F	ACQUISITION AND COMMAND SUPPORT	0	-30
65807F	TEST AND EVALUATION, SPT	0	-130
TOTAL		0	-2,600

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61101F
 DOD Mission Area: Defense Research, #510

Title: In-House Laboratory Independent Research
 Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,000	10,200	11,500	13,600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This effort is spread among thirteen research and development laboratories and provides discretionary funds to the Laboratory Directors to pursue new work of high promise or importance. The program is personally reviewed annually by the Assistant Secretary for Research, Development and Logistics. No higher headquarters approval or justification is required prior to starting the work, which is usually a one-time effort to initiate activities on time-critical ideas.

BASIS FOR FY 1982 RDT&E REQUEST: To provide the Laboratory Directors discretionary funds to pursue new high-promise work in a timely manner.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,000	10,200	11,600		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable

Program Element: #61101F

DOD Mission Area: Defense Research, #510

Title: In-House Laboratory Independent Research
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides discretionary authority to Laboratory Directors of the Air Force Systems Command for new research work judged to be of high promise or importance. The Air Force has set up and administered this program in strict compliance with the intent that it would be unencumbered by restrictive reviews and procedures or justifications and documentation prior to beginning work. Laboratory Directors meet annually with the Assistant Secretary of the Air Force for Research, Development and Logistics to account for their research projects.

(U) RELATED ACTIVITIES: Efforts accomplished through this program are of significant importance and are an integral part of the total work being done in the Air Force Laboratories. Usually funds are used to start or expand particularly promising work and continue for one year or until the work is transitioned to the regular program. The responsibility for insuring against unwarranted duplication of efforts rests with the Laboratory Directors. Similar programs are funded by the Army and Navy.

(U) WORK PERFORMED BY: Numerous small and moderate size contracts are placed with universities and industry each year, in conjunction with directly related in-house laboratory efforts, to investigate promising new areas of Research and Exploratory Development. Directors of the Air Force in-house Laboratories are supported by and participate in this program. The ten major contractors were: Systems Research Laboratories, Inc., Dayton OH; Georgia Tech Research Institute, Atlanta GA; Aerojet Solid Propulsion Co., Sacramento CA; Charles Stark Draper Labs, Inc., Cambridge MA; United Technologies Research Center, East Hartford CT; Rockwell International Corp., Los Angeles CA; Atlantic Research Corp., Alexandria VA; Honeywell Inc., Bloomington MN; Environmental Research Institute of Michigan, Ann Arbor MI; Vought Corporation Advanced Tech Center Inc., Dallas TX. There are 106 additional contractors doing work under 117 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

(1) Conversion of Whole Crude Shale Oil: The principle technical barrier to the economical production of useable fuels from shale oil is the high nitrogen content. A unique catalyst system that is capable of lowering the nitrogen content of shale oil from 3200 parts per million to less than 10 parts per million in a single step process was developed. This single step process provides 25 percent more jet fuel processing material from crude shale oil than conventional catalyst systems.

(2) Low Cost Titanium Tankage Fabrication: Currently, the only way to fabricate titanium satellite tanks involve a very expensive forge and machine process due to the welding and heat treatment limitations of titanium. The feasibility of a fabrication technique for reducing the cost of satellite propulsion titanium tanks by 30-50% was demonstrated.

(3) Aircraft Oxygen Generation by Membrane Permeation: Demonstrated a membrane permeation system capable of providing oxygen suitable for aircrew breathing.

(4) Elevated Temperature Aluminum Powder Alloy Development: The use of current high strength aluminum alloys are limited to operating conditions below 250° Fahrenheit. Using powder metallurgy techniques, the feasibility was demonstrated of developing aluminum based alloys, capable of withstanding temperatures greater than 450° Fahrenheit for use as a replacement for titanium and steel in selected engine components.

(5) Fuel Microemulsions for Jet Engine Smoke Reduction: Successfully created jet propellant 4 and 8 microemulsions with water, methanol and ethanol that reduce smoke emissions for use in meeting jet engine test cell air pollution regulations.

Program Element: #61101F

DOD Mission Area: Defense Research, #510

Title: In-House Laboratory Independent Research
Budget Activity: Technology Base, #1

(6) Pore Pressure Measurement Probe: One of the important criteria in predicting soil response to severe blast loading is the underground pressure of the fluid in the space between the soil particles. Instrumentation was successfully developed that separates the particle effects from the fluid pressure.

(7) Aircraft Ground Mobility System: Designed and fabricated high flotation track assemblies which can be quickly attached to F-16 aircraft tires for off-runway taxi/tow operations.

(8) Space Environmental Support System: Demonstrated the operation of a Space Environmental Support System Data Communicator prototype which automated the acquisition, the processing and communication to the Air Force Global Weather Central of the space environmental data in real time.

(9) Sensor Development: Demonstrated a sensor capability, which shows potential use in tactical weapons for the detection and range of non-radiating radars.

(10) Aircrew Protective Restraint Systems: Developed a prototype test fixture which will be used in human centrifuge and impact testing programs designed to evaluate the aeromedical aspects of aircrew protective restraint systems.

2. (U) FY 1981 Program: The distribution of 10.3 million was approved by the Assistant Secretary of the Air Force for Research, Development and Logistics. Participating Laboratory Directors will again select projects of high promise to be supported.

3. (U) FY 1982 Planned Program: The program will continue as in FY 1981. Individual tasks will be determined during the year at the discretion of the Laboratory Directors, who will be participating in this program.

4. (U) FY 1983 Planned Program: The program will continue with individual tasks being determined during the year at the discretion of the Laboratory Directors, who will be participating in this program.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #61102F
DoD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) (\$ in Thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs	Not Applicable
	TOTAL FOR PROGRAM ELEMENT	110,190	118,540	142,700	178,700			
2301	Physics	11,146	13,080	14,900	16,600			
2303	Chemistry	10,972	12,140	13,740	17,000			
2304	Mathematics	10,474	11,070	13,440	20,200			
2305	Electronics	12,616	13,480	19,240	22,500			
2306	Materials	15,735	16,640	18,010	23,700			
2307	Mechanics	16,928	17,390	22,530	28,700			
2308	Energy Conversion	7,464	8,780	9,640	12,200			
2309	Terrestrial Sciences	1,942	2,080	2,430	2,700			
2310	Atmospheric Sciences	7,344	7,830	8,720	10,600			
2311	Astronomy and Astrophysics	4,609	4,710	5,220	6,300			
2312	Biological and Medical Sciences	5,298	5,750	8,380	10,100			
2313	Human Resources	5,662	5,590	6,450	8,100			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is dedicated to the advancement of military aerospace technology through scientific research.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Increased funding for FY 1982 will be used for five new major initiatives/thrusts. Their goals and funding levels are as follows: (1) Aerodynamics of Fuel Efficient Aircraft (\$2.1 million, Project 2307); (2) Aerodynamics of Low Speed Take Off and Landing (\$1.2 million, Project 2307); (3) Weapon System Automation (\$1.0 million, Project 2304); (4) Manufacturing Sciences (\$3.7 million, Project 2305); and (5) Chemical Agent Defense (\$2.0 million, Project 2312). Details on these initiatives are described in the section, "FY 1982 Planned Program", which follows and also in the descriptive summaries of the projects which encompass them. In addition to these initiatives a broad base of scientific research will be carried out within the project resources listed above. All programs are directed toward the improvement of Air Force technology.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

Project Number	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs	Not Applicable
	110,000	134,100	159,900				

RDT&E (\$ in Thousands)

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element supports the entire Air Force research program including extramural and in-house investigations. It encompasses those scientific areas in which technological progress is judged essential for advancing Air Force capabilities. The principal thrusts of these research programs are in the areas of biological and medical science, propulsion and power, aerospace structures and aerodynamics, materials, atmospheric and space sciences, electronics, laser weapons, particle beams, and conventional weapons.

(U) RELATED ACTIVITIES: Program coordination among government agencies is achieved through annual interagency meetings and data exchange with the Army, Navy, National Science Foundation, Department of Energy, National Aeronautics and Space Administration, Federal Aviation Administration, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and other Federal research activities. Other means of coordination include annual briefings to the Under Secretary of Defense for Research and Engineering, attendance at technical symposia and topical reviews covering research areas of common interest, and triservice activities such as the Joint Service Electronics Program. In addition, particularly effective coordination is accomplished on an informal basis among individual Air Force program managers and their counterparts in other agencies or with scientists whose research is supported by other government sources.

(U) WORK PERFORMED BY: The Air Force basic research program is conducted predominantly under extramural grants and contracts with academic institutions and industry. The entire Air Force research program, extramural and in-house, is managed by the Air Force Office of Scientific Research, Bolling AFB, DC. Research is now underway in-house at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Air Force Armament Laboratory, Eglin AFB, FL; Air Force Weapons Laboratory, Kirtland AFB, NM; Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; Air Force Geophysics Laboratory, Hanscom AFB, MA; Air Force Human Resources Laboratory, Brooks AFB, TX; Aerospace Medical Division, Brooks AFB, TX; Frank J. Seiler Research Laboratory, USAF Academy, CO; and the Rome Air Development Center, Griffiss AFB, NY. The ten major contractors are: University of California primarily at Berkeley and Los Angeles, CA; Massachusetts Institute of Technology, Cambridge, MA; Stanford University, Stanford, CA; University of Southern California, Los Angeles, CA; SRI International, Menlo Park, CA; Systems Research Laboratories, Dayton, OH; University of Texas, Austin, TX; Georgia Institute of Technology, Atlanta, GA; University of Arizona, Tucson, AZ; and University of Illinois, Urbana, IL. In total, there are 290 contractors with 1,100 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

- (1) Free Electron Laser: The first demonstration of the free electron laser was sponsored by this program element in 1978. The free electron laser presents a fundamentally new and promising approach to the development of high energy lasers. Present Air Force programs are extending these results to more advanced experiments. Other agencies are initiating development programs.

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(2) Ultra High Power Microwave Sources: The first demonstration of superpower microwave generation with relativistic electron beams was carried out under this program element in 1979. Record power levels of 3 gigawatts (3 billion watts) have been generated at a wavelength of 10 centimeters with a relativistic magnetron and 10 megawatts at submillimeter wavelengths with a Raman mode device. These power levels represent factors of ten or more increase over that obtained from conventional sources and have the potential of substantially increasing our capabilities in radar and electronic countermeasures.

(3) Carbon-Carbon Rocket Nozzle Materials: The first comprehensive synthesis technique for fabrication of carbon-carbon billets for rocket nozzles based on computer aided design of both weave and thermal cycle was successfully developed under this program in 1980. This processing guidance was applied to MX missile system manufacturing technology billets with a significant reduction in cracking. Carbon-carbon rocket nozzles are planned for use in all three stages of the MX missile.

(4) Robust Signal Processing: The first mathematical treatment of signal encoding against non-gaussian noise without the assumption of independent sampling was developed under this program element in 1980. These mathematical techniques use sliding block encoding to provide robust processing of noisy signals in communication and radar systems. They allow for signal detection and encoding at very high sampling rates, a feature required in hostile signal environments (especially jamming environments) when the need for rapid decisions is the greatest. The performance of systems using existing techniques is highly dependent on the statistical assumptions used during system design whereas the new techniques provide acceptable performance even with little exact prior knowledge of the statistical properties of the noise.

(5) Hydrazine Carcinogenesis: A breakthrough in attempts to determine early indicators of latent toxic effects of hydrazine chemicals has been achieved under this program element during 1980. Carcinogen treated hamsters demonstrated a decrease in a specific chromatin-binding biochemical long before tumors were formed. This new testing technique has the potential for significantly reducing the time and cost of testing for carcinogenicity of chemicals of Air Force interest. In particular, hydrazine based fuels are used in the Titan II missile system and for the F-16 emergency power unit.

(6) Auroral Zone Vertical Structure: The first direct observation and presentation of the variation in the vertical structure of the polar auroral zone, so important to the performance of over-the-horizon radar and communication systems in the polar regions, was made under this program element during 1980. Documentation of auroral zone structural variations could provide significant insight into anomalous propagation occurrences in polar communications and surveillance.

(7) Optical Image Correlators: The first demonstration of optical correlation of radar images with target scenes previously stored on photographic images was carried out under this program element during 1979. This advance in optical signal processing promises to have great impact on future systems designed to achieve real-time autonomous target acquisition because of the inherent parallel processing capability that exists with optical image correlators.

2. (U) FY 1981 Program: See individual project descriptive summaries.

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

3. (U) FY 1982 Planned Program: The FY 1982 research funding request will permit the Air Force to carry out five new major initiatives/thrusts.

- (1) Research programs to explore aerodynamic phenomena which will enhance the energy efficiency and capabilities of tactical air vehicles. Specific research efforts will be directed towards the aerodynamics of friction and form drag reduction, and lift and thrust enhancement from unsteady, large amplitude wing motions. The potential application of active control of wing motion to reduce drag and enhance efficiency will be explored. This initiative will be carried out under Project 2307.
- (2) Research programs which explore the aerodynamic phenomena associated with very low speed take off and landing. Included in this initiative are efforts to understand interaction of high speed jets with surfaces, the aerodynamic interaction of propulsive lift jets, the mixing of co-flowing turbulent streams, and the aerodynamics of axial flow compressors. This initiative will be carried out under Project 2307.
- (3) Research in systems automation which will address the sciences underlying guidance and control of standoff weapons, remotely piloted vehicles, and unmanned space systems. These research programs will combine basic research in artificial intelligence, decision and control theory, and control systems dynamics, the fields most likely to make important contributions toward future systems in which post-launch human intervention will be minimal. This initiative will be carried out under Project 2304.
- (4) Research directed to the sciences of manufacturing. This program will emphasize technologies associated with the latter stages of the manufacturing cycle when the value of assembled and tested products is highest. These technologies are optical recognition and metrology, computer vision, robotic controls, multistate acceptance and nondestructive evaluation. This initiative will be carried out under Project 2305.
- (5) Research directed toward the defense of Air Force systems and personnel against chemical agents. This research will incorporate efforts in analysis of the chemical properties of chemical agents, detection systems, transport of chemical agents by the environment, protective products, and the physiology and biochemistry of chemical agents. This research program is being coordinated with and will complement Army chemical defense research. This initiative will be carried out under Project 2312.

In addition to the above five new major FY 1982 initiatives, the FY 1982 research funding request will permit the Air Force to continue to place increased funding emphasis on two major FY 1981 initiatives.

- (1) Increased research will continue to be directed toward those scientific areas expected to contribute to the development of directed energy weapons. Free electron laser oscillator experiments will be conducted, and prime power sources for particle beam systems, including both generation and storage concepts, are planned for increased study. Theoretical studies of the propagation of neutral and ion beams from the exoatmospheric region into the atmosphere are planned. An expanded effort in X-ray sources will probe the basic physics necessary for the generation of directed energy at X-ray wavelengths.

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Defense Research Sciences
Budget Activity: Technology Base, #1

(2) The FY 1981 initiative directed toward the understanding of the response of strategic missile system support facilities in the presence of high level dynamic loads associated with ground shock and air blast will be continued. Extensive measurements will be conducted of the high strain rate performance of structural materials. Analyses will be conducted to advance the theory of propagation of high strain rate shock waves through soils and the resulting effects on protective structures.

The FY 1982 research funding request will also allow for a continuation with limited expansion of the broad core program in basic research required to provide the advancements needed by the Air Force to maintain technical excellence. Detailed information on the specific research to be conducted in the various scientific and technical areas is contained in the individual project descriptive summaries.

The "FY 1982 Planned Program" contained in last year's descriptive summaries was based on a funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. However, the FY 1981 budget request was reduced from \$134.1 million to \$125.4 million by the Office of the Secretary of Defense after the submission of the President's Budget, and was subsequently reduced to \$118.54 million by Headquarters Air Force to partially accommodate a general reduction of the RDT&E appropriation by Congress. As a result of the FY 1981 reductions, the FY 1982 request has been reduced to \$142.7 million. Details on how the FY 1982 reduction was accommodated are contained in the individual project descriptive summaries.

4. (U) FY 1983 Planned Program: See individual project descriptive summaries.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #2301

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Physics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The research program in physics provides scientific information to the technology base to help solve Air Force problems in new weapon systems development, electromagnetic countermeasures, nuclear weapons effects, nondestructive testing and new materials development. To provide the necessary scientific knowledge, work is supported in optical physics, plasma physics, electricity and magnetism, atomic and molecular physics, particle beam technology, and physics of collective phenomena.

(U) RELATED ACTIVITIES: Program coordination among government agencies is achieved through annual interagency meetings involving the Army, Navy, Department of Energy, Defense Advanced Research Projects Agency, Defense Nuclear Agency, and the National Science Foundation; annual program briefings to the Under Secretary of Defense for Research and Engineering; formal and informal discussions among scientists and engineers in the Services; and by attendance at symposia and topical reviews covering research areas of common interest. In addition, the Air Force research program in physics is related to other Air Force programs through discussion with laboratory personnel at annual technical reviews and through participation in various technology planning meetings.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH and the Air Force Weapons Laboratory, Kirtland AFB, NM. The ten major contractors are the University of Arizona, Tucson, AZ; Stanford University, Stanford, CA; Science Applications, Inc., La Jolla, CA and Palo Alto, CA; Texas Tech University, Lubbock, TX; University of California, Santa Barbara, CA; Boston University, Boston, MA; Cornell University, Ithaca, NY; Battelle Memorial Institute, Columbus, OH; University of Rochester, Rochester, NY; Los Alamos National Scientific Laboratory, Los Alamos, NM. In total, there are 85 contractors with 139 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) A technique has been developed for measuring molecular processes to one pico-second (one-trillionth of a second). This technique will not only improve basic understanding of fast processes in electronic and biological materials, but has also led to the successful demonstration of a photoacoustic microscope. The ability to study processes on this time-scale will add immensely to the understanding of numerous physical phenomena, greatly enhancing the ability to create new technologies and devices to meet Department of Defense needs. (2) Design and analysis of a critical free electron laser experiment to demonstrate that the free electron laser can be made efficient has been completed. This Air Force-supported effort is the basis of a joint Air Force/Defense Advanced Research Projects Agency-funded, Air Force Office of Scientific Research-managed experimental program at Los Alamos which addresses technological questions on obtaining very high power directed energy through the revolutionary free electron laser concept. (3) A soft X-ray source with spectral brightness several orders of magnitude higher than any existing source has been developed. This X-ray source, and others based on the same principles, will allow comparatively inexpensive measurements to replace those currently requiring access to large, expensive electron accelerator facilities. Sources such as those demonstrated could have important uses in tracking neutral particle beams, in addition to enabling numerous X-ray studies on various topics to be performed much more conveniently and cheaply than at present. (4) Ultrahigh-power microwave sources, developed with relativistic electron beam technology, have produced a record power level of 10 megawatts at submillimeter wavelengths and a power level of 3 gigawatts (3 billion watts) at a longer wavelength of 10 centimeters. These power levels represent factors of ten or more increase over that obtained from conventional sources

Project: #2301

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Physics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

and may substantially increase our capabilities in radar and electronic countermeasures. (5) An experiment with stored magnesium ions has demonstrated key principles involved in a time (or frequency) standard. Laser techniques were used to cool the ions to about 0.50K making possible the observation of a large change in the optical output for each photon of a microwave (clock) frequency absorbed. This concept has the potential for radically improving the stability and accuracy of time/frequency standards, a vital factor in many earth and space-borne systems and missions.

2. (U) FY 1981 Program: The directed energy thrust is focused in several specific areas. Key experiments are being performed on a variety of free electron lasers. Gain and energy extraction in linear accelerator beams and recirculation of current in a Van de Graaff generator are being demonstrated. The physics of X-ray production and interaction is being addressed to enhance the understanding of basic problems associated with directed energy at X-ray wavelengths and to gain additional capabilities for the simulation of weapons effects. Increased support in the particle-beam technology area is being applied to theoretical and experimental studies of negative ion sources for exoatmospheric neutral beam applications, to theoretical studies of high-current ion propagation phenomena and to the exoatmospheric detection and tracking of neutral beams. In other research areas, a new effort is being started in nonlinear optics in single crystal fibers. Efforts are being maintained to gain further understanding of solid electrolytes, high temperature and high magnetic field superconductors, and the aging and stressing of materials.

3. (U) FY 1982 Planned Program: The directed energy thrust will be continued. Free electron laser oscillator experiments will be conducted and prime power sources for particle beam systems, including both generation and storage concepts, are planned for increased study. Theoretical studies of the propagation of neutral and ion beams from the exoatmospheric region into the atmosphere are also planned. An expanded effort in X-ray sources will probe the basic physics necessary for the generation of directed energy at X-ray wavelengths. The effort in nonlinear optics in single crystal fibers will be expanded into a major program. The ability to take advantage of nonlinear optical processes on the scale of a meter and longer rather than the centimeter scales currently used will lead to dramatic new capabilities in optical sources, frequency converters, etc., for application to optical countermeasures, recording magnetometers, and time standards, as examples. Another new program area in laser-induced, nonequilibrium processes at surfaces is planned. This work can lead to dramatic new capabilities in surface diagnostics, preparation and coating. A program in laser detection of very small amounts of materials will be given additional emphasis.

4. (U) FY 1983 Planned Program: Recovery of the energy from an electron beam in an RF linear accelerator will be demonstrated as the last key principle in the feasibility demonstration of high efficiency, ultra high energy free electron lasers. Funding for studies of the generation of incoherent and coherent X rays will remain constant while studies of certain aspects of propagation and interaction will increase. Pulsed-power studies will remain level, while funds for specific aspects of particle acceleration, propagation, and detection will increase. Finally, the funding for studies of countermeasures to particle beams will be increased.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

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(37)

Project: #2301

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Physics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RD&E Funds	11,146	13,080	14,900	16,600	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	10,200	12,510	14,790		Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts.

Project: #2303

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Chemistry

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Research in chemistry includes: (1) synthesis and characterization of inorganic and organic materials for utilization in structural composites, lubricant systems, sealants, and fluids; (2) electrochemical processes important for improved batteries and new analytic methods for utilization in combustion diagnostics; (3) energy conversion processes fundamental to high energy laser development; (4) atmospheric chemistry responsible for influencing the operational Air Force environment; and (5) methods of synthesis of advanced ingredients for rocket fuels.

(U) RELATED ACTIVITIES: The Air Force chemistry program is coordinated through a federal interagency panel which includes participation by the Army, Navy, Department of Energy, National Science Foundation, National Institutes of Health, National Aeronautics and Space Administration, and the Environmental Protection Agency. Coordination is also achieved through triservice programs or special topical reviews of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Air Force Weapons Laboratory, Kirtland AFB, NM; the Air Force Geophysics Laboratory, Hanscom AFB, MA; the Frank J. Seiler Research Laboratory, USAF Academy, CO; and the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA. The ten major contractors are the Massachusetts Institute of Technology; Cambridge, MA; Battelle Memorial Institute, Columbus, OH; University of Texas, Austin, TX; Harvard University, Cambridge, MA; SRI International, Menlo Park, CA; State University of New York, Buffalo, NY; Stanford University, Stanford, CA; University of California, Los Angeles, CA; University of Florida, Gainesville, FL; and University of Colorado, Boulder, CO. In total there are 77 contractors with 127 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) The most recently discovered gas laser system is the iodine fluoride laser, which emits in the visible red spectrum following photoactivation at a higher frequency (green). Methods to produce by chemical reaction the same activated iodine fluoride source to form, thereby, a new "chemical" laser are under active investigation. Earlier research (in 1977) produced the iodine, activated oxygen transfer chemical laser emitting in the near infrared and earlier (1966) the first entirely chemical series of infrared emitting lasers that included the hydrogen fluoride system. (2) Research completed on improved processing of carbon-carbon composites has resulted in material for rocket nozzles with marked reduction in high-temperature, pressure autoclave processing costs. This processing guidance was applied to MX missile system manufacturing technology billets with a significant reduction in cracking. (3) Continued efforts in advanced polymer composites reveal the promise of a molecular composite system structurally self-reinforced by internally dispersed ordered bundles of stiff, rod-like polymer molecules. The ordered polymer fibers have been shown to possess resistance to oxidative degradation while also having high tensile strength and modulus of elasticity (in comparison with metals and the best available organic materials). (4) A powerful new approach to analysis of materials structure has been demonstrated based on X-ray absorption fine structure. In contrast with previous methods employing large-scale synchrotron accelerator storage rings as a source of X rays, the present approach will afford a laboratory size device of relatively low cost utilizing a laser generated plasma as an X-ray source.

Project: #2303

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Chemistry

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Technical emphasis is placed on four areas of research: molecular kinetics, non-metallic structures, surface dependent properties, and synthesis. Included in molecular kinetics are the rates and mechanisms of chemical reactions, the dynamics of energy transfer processes, and applied spectroscopy for chemical analysis. In this area growing importance is assigned atmospheric processes and the diagnostics of exhaust plumes. Research in chemical lasers is being decreased somewhat but is continuing as an important part of the overall program. The effort in non-metallic structures includes the structure-property relationships of polymers, glasses, and ceramics. A major initiative is being undertaken on microprocessing of composite systems of glass-ceramics and glass-polymers as well as individual components. Special attention is also provided ion transport mechanisms in solid state and fused inorganic electrolytes for specialized battery systems. Continued emphasis will promote further improvement in the unconventional molecular composite systems. The program in surface dependent properties addresses electrode surface processes as well as adhesion, surface reactivity, and lubrication. Research in synthesis is directed at improved propellant ingredients, energetic binders and plasticizers, and at advanced processible thermosetting polymer binders for conventional composites with higher service temperature. A new initiative is being undertaken to synthesize a new class of advanced hydraulic fluids with controlled viscosity and environmental resistance at high temperature.
3. (U) FY 1982 Planned Program: Major shifts in emphasis from the previous year are not planned. The overall levels of funding for molecular kinetics and synthesis will be maintained with real growth foreseen for non-metallic structures and surface dependent properties. New emphasis is planned for investigation of the electronic properties of the ordered polymer systems following the previous concentration on their mechanical properties. More attention is to be placed on thermoset polymer processibility, network morphology, and thermomechanical properties. Surface research will address new, selected aspects of the interface chemistry of semiconductor materials such as film growth and reactivity with coatings.
4. (U) FY 1983 Planned Program: Planned research in the four areas of research emphasis will undergo a moderate expansion with changes in specific content occurring where successful accomplishments are transitioned to development and where new opportunities are recognized. On the more programmatic side, an increased share of the overall resources available will be invested in the powerful, yet expensive, new items of capital equipment required for the most productive, rapid and comprehensive research. A continued shift is expected to carefully selected larger contract research efforts to assure the most efficient, productive use of available resources.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #2303

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Chemistry

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RD&E Funds	10,972	12,140	13,740	17,000	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	11,000	13,470	16,060	Continuing	Not Applicable
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The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$2,320 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate was accomplished by restricting earlier planned research growth. Planned major programs in molecular kinetics of combustion reactions were postponed. The planned rate of increase in emphasis on polymer microprocessing for electronic applications was restricted.

Project: #2304

Program Element: #61102F

DDO Mission Area: Defense Research, #510

Title: Mathematics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of the research program in the mathematical sciences is to produce new mathematical and computational techniques needed to solve mathematical and computer problems occurring in Air Force aerospace systems; aerodynamic design of aircraft, missiles, and weapons; command, control, computers including software, and communications systems; surveillance and reconnaissance systems; systems reliability and maintainability; resource allocation systems for logistics and operational activities; and computer software.

(U) RELATED ACTIVITIES: The coordination of this program among government agencies is achieved through annual interagency meetings involving the Army, Navy, Department of Energy, and the National Science Foundation; annual program briefings to the Under Secretary of Defense for Research and Engineering, and by attendance at symposia and topical reviews covering research areas of common interest. In addition the Air Force program in mathematical research is tied to other Air Force research and development programs through participation in planning activities, and through coordination with Air Force laboratory personnel at annual technical reviews of programs.

(U) WORK PERFORMED BY: In-house mathematics research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Air Force Armament Laboratory, Eglin AFB, FL; Air Force Weapons Laboratory, Kirtland AFB, NM; Frank J. Seiler Research Laboratory, USAF Academy, CO; and Rome Air Development Center, Griffiss AFB, NY. The ten major contractors are: Stanford University, Stanford, CA; Brown University, Providence, RI; University of Michigan, Ann Arbor, MI; University of Maryland, College Park, MD; Massachusetts Institute of Technology, Cambridge, MA; University of Pittsburgh, Pittsburgh, PA; University of California, Berkeley, CA; SRI International, Menlo Park, CA; University of Southern California, Los Angeles, CA; and University of Illinois, Urbana, IL. In total there are 84 contractors with 202 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Past results from this program include such items as the Kalman filter, the mainstay of practically all digital signal processing and digital control technologies, and the Viterbi algorithm, a current powerful method of coding communication signals. (2) New experimental results in computer science have validated previously untested hypotheses on the value of structured programming. Experiments indicate that software development projects requiring several programmers could achieve in excess of 50% increase in productivity using a highly structured, disciplined approach. These results are the first published using accepted experimental methods. (3) An open question regarding realizability of certain classes of electronic network problems has been answered, implying the availability of more powerful techniques to design digital filters for aerospace signal processing systems. (4) Another signal processing advance was the discovery that the original sample function of a random process contains all necessary information to analyze the signal. This result is expected to significantly reduce computational time and computer storage space for future digital processing functions. (5) New robust methods for processing noisy signals inherent in communications and radar systems have been developed to replace the classical techniques used in present systems. These new techniques will give superior performance to existing ones in that they are much less dependent on prior knowledge of the noise. (6) A highly innovative mathematical technique has been discovered that allows economical digital computer analysis of complex computational problems encountered in aircraft, missile and engine design. These techniques provide an adaptable grid to

Project: #2304

Program Element: #61102F

DOD Mission Area: Defense Research, #510

Title: Mathematics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

integrate the numerical techniques with the specific geometry of the boundaries being studied. (7) A new general and intuitive mathematical technique has been developed for generating artificial boundary conditions used to simulate infinite domains encountered in the solution of the partial differential equations that occur frequently in physical models of aerospace phenomena. A promising area for application of such techniques is in the study of jet acoustics problems.

2. (U) FY 1981 Program: Major efforts are continuing to investigate methods to improve reliability and reduce costs for software in computer systems and to study the architecture of computing systems with a large number of processors. Control systems research is being targeted at adaptive control systems. Numerical analysis research is being carried out on the solution of differential equations which model flow fields for aircraft-type structures. Investigations are beginning to examine parallel processing algorithms for major engineering problems. In statistics a major effort is continuing to extend reliability theory to include more realistic constraints. In the general area of stochastic processes a major program is being continued and expanded. In system science new programs in distributed decision modeling, which hold promise of application to command, control and communications theory, are being continued. Non-parametric techniques for signal processing are becoming a major part of this program. Modern control theory is being deemphasized. Traditional methods for analysis and solution of differential systems are being deemphasized. Continued effort is being made to assist in-house Air Force scientists and engineers in solving problems related to mathematics. Additional funds provided this year are being used to expand the FY 1980 programs in command and control and non-parametric statistical communications techniques and to initiate new work in algorithms for parallel processing techniques.

3. (U) FY 1982 Planned Program: A major new thrust (totaling \$1.0 million) will be initiated to investigate and define the mathematical and computer science issues that limit total systems automation. Research in systems automation will address the sciences underlying the guidance and control of stand-off weapons, remotely piloted vehicles and unmanned space systems. These research programs will combine basic research in artificial intelligence, decision and control theory, and control system dynamics, the fields most likely to make important contributions toward future systems in which post launch human intervention will be minimal. In addition to this major thrust, evaluation will be made of computer science research designed to automate programming and to combine this method with the formal methods of proof-of-correctness to obtain more efficient ways of coding and verifying software. Continued emphasis will be placed on computationally efficient methods for solving the equations which govern behavior of structural designs and aerodynamics with the objective of extending recent results to the three dimensional case. The parallel algorithm program initiated in FY 1981 will be significantly expanded. New analytical theories will be investigated to further examine the chaotic solutions of nonlinear problems. Continued emphasis will be placed on multivariate reliability analysis, and stochastic processes. Research will be initiated to generalize stochastic processes to topology with the expectation of solving outstanding problems in image processing. Signal processing will continue to be a major part of this program. Control Theory will be deemphasized.

Project: #2304

Program Element: #61102F

000 Mission Area: Defense Research, #510

Title: Mathematics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

4. (U) FY 1983 Planned Program: It is planned to emphasize software reliability techniques, systems automation techniques, statistical communication theory, and advanced numerical and nonlinear techniques for parallel processors. Possible new avenues for investigating command and control will evolve. Stochastic processing research should open new avenues to pursue in the area of signal processing. Continued effort will be placed on transferring advanced mathematical techniques available to in-house Air Force scientists and engineers engaged in solving problems occurring in aerodynamics, command and control, communications and various Air Force operational problems. Additional funds will be used to support new activities in communication theory, computer science, nonlinear mathematics and distributed processing.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDIT&E Funds	10,474	11,070	13,440	20,200	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	10,700	13,210	15,700	Continuing	Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$2,260 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate was accomplished by reducing planned funding for the continuing program and starting the major new initiative/thrust in weapon systems automation at \$1.0 million.

Project: #2305

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Electronics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The research program in electronics seeks to provide the fundamental knowledge required to advance the Air Force capabilities in surveillance, guidance and control, information and signal processing, communications, and command and control. These topics include optical signal processing for target recognition and terminal guidance; compound semiconductor devices for high speed digital signal processing, and for microwave power generation; electromagnetic propagation; antennas; target signatures; microwave tube science; magnetostatic and electro-acoustic analog signal processing devices; integrated optics for advanced gyroscopic sensors; nuclear radiation hardening; and robust communications techniques for command and control. Two new areas of major emphasis are research on modeling the phenomena of ultra submicron electronic devices and on the science of manufacturing.

(U) RELATED ACTIVITIES: Electronics research is coordinated through the program reviews of the Under Secretary of Defense for Research and Engineering including the Technical Coordinating Paper on Electronics. Coordination with other research agencies is obtained through data exchange with the Office of Naval Research, the Army Research Office, and the National Science Foundation. The Joint Services Electronics Program is funded within this project and is managed by a Technical Advisory Committee with one representative from each service and a Technical Review Panel with representatives drawn from the three services.

(U) WORK PERFORMED BY: In-house electronics research is now underway at the Rome Air Development Center, Griffiss AFB, NY; the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH, and the Air Force Armament Laboratory, Eglin AFB, FL. The ten major contractors are: University of Southern California, Los Angeles CA; Polytechnic Institute of New York, Brooklyn NY; University of California, Berkeley CA; University of Texas, Austin TX; Stanford University, Stanford CA; Massachusetts Institute of Technology, Cambridge MA; Cornell University, Ithaca NY; Varian Associates, Palo Alto CA; Ohio State University, Columbus OH; and Carnegie-Mellon University, Pittsburgh PA. In total, there are 60 contractors with 97 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) A new surface acoustic wave device was discovered which will drastically reduce the size required for narrowband filters in the frequency range from a few megahertz to a few gigahertz for applications in airborne communications and electronic warfare. (2) A laser technique was discovered for repairing micron-sized open and short circuit failures in large-scale integrated circuits using photodeposition and photoetching. The technique is already being pursued by the semiconductor industry for repairing the expensive photo masks used to produce integrated circuits. (3) A new solid state microwave device has been fabricated using submicron grids of metal grown in a multilayer compound semiconductor. This new device, the permeable base transistor, appears capable of extending the upper frequency range of microwave transistors by tens of gigahertz. (4) Two new techniques for the preparation of compound semiconductor devices were developed during the course of research on this important class of high speed devices. The first new technique uses a hydroplaning effect to etch-polish large semiconductor wafers to a flatness of better than 0.1 micrometer with no damage to the semiconductor surface. The second advance uses molecular beam

Project: #2305

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Electronics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

epitaxial doping with silicon and germanium to form extremely low resistance contacts to gallium arsenide transistors, thereby increasing their speed and upper frequency limits. (5) An optical correlator was demonstrated for the first time which matched radar images of a target scene with previously stored photographic images of the same scene. This advance and several others in the optical signal processing program have great potential for autonomous target acquisition.

2. (U) FY 1981 Program: Fundamental research for the current year is being increased in the areas of molecular beam epitaxy of compound semiconductors, surface acoustic wave filters and signal processors, optical signal processing, and the effects of space radiation on integrated circuits. A new thrust is starting in the modeling of ultra submicron electron devices in anticipation of advances in fabrication that will allow exploration of this size regime that is technologically important, but is not adequately described either by atomistic models on the small side or bulk models on the large side. Device feature sizes of the order of 100 Angstroms are being considered, which is much smaller than the goals for feature size of the Very High Speed Integrated Circuit program.

3. (U) FY 1982 Planned Program: A major new thrust (totaling \$3.7 million) will be initiated to address the sciences of manufacturing with emphasis on the latter stages of the manufacturing cycle where the value of assembled and tested products is highest, rather than in the early stages of the manufacturing cycle where individual parts are formed and fabricated. The research program will incorporate efforts in materials fabrication and forming, optical recognition and metrology, computer vision, robotic controls, multistate acceptance, and nondestructive evaluation. Emphasis in the core program of electronics research will be increased in the areas of ultrasubmicron electronics research mentioned above, and in hybrid optical/digital systems for real time computation. The forming and fabricating processes are being addressed adequately by a new Department of Commerce thrust and by our own core program of research in project 2306 on structural materials. The research base in optical processing for target recognition will be used to address optical part recognition and optical metrology for robotic assembly. Digital information processing will be investigated for application to part recognition, adaptive process control, and decision processes concerned with re-work and re-test of partially completed assemblies.

4. (U) FY 1983 Planned Program: The electronics program for FY 1983 will expand the program areas above, while seeking to stimulate fundamental innovative science in areas of intelligent sensors, high speed information processing, target identification and terminal guidance, inertial guidance, and communications.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2305

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Electronics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDI&E Funds	12,616	13,480	19,240	22,500	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	12,100	14,730	17,530	Continuing	Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$1,710 thousand increase in the FY 1982 estimate compared with last year's FY 1982 estimate will provide part of the additional funding for the major new initiative/thrust (of \$3.7 million) in manufacturing sciences.

Project: #2306

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Materials

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force materials research program investigates phenomena which have potential for improved performance, cost and reliability of both structural materials and electronic materials. The structural materials research program studies a broad range of material properties such as strength, fatigue resistance, and corrosion resistance of airframe and turbine engine materials with primary emphasis on titanium, aluminum, and nickel based alloys as well as ceramics. A strong program of research in non-destructive evaluation of these materials complements research on improved properties. The electronic materials research program is concerned with semiconductor, optical and magnetic materials of interest for avionics, surveillance, communications, guidance, and electronic warfare. Emphasis is placed on compound semiconductors, superconductors, surface acoustic wave and magnetostatic wave materials, fiber optic and integrated optic materials, and high purity quartz for time and frequency standards. An increasing program of research on reliability of semiconductors and on their radiation hardness complements the research on improved properties.

(U) RELATED ACTIVITIES: Materials research is coordinated through the Under Secretary of Defense for Research and Engineering Materials Technology Coordinating Paper and the Interagency Materials Coordinating Group which includes the National Science Foundation, Department of Energy, National Aeronautics and Space Administration and the military services.

(U) WORK PERFORMED BY: In-house materials research is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; and the Rome Air Development Center, Griffiss AFB, NY. The ten major contractors are: Systems Research Laboratories, Dayton, OH; Stanford University, Stanford, CA; Massachusetts Institute of Technology, Cambridge, MA; Rockwell International Corporation, Thousand Oaks, CA; University of Southern California, Los Angeles, CA; Battelle Memorial Institute, Columbus, OH; Cornell University, Ithaca, NY; Hughes Research Laboratory, Malibu, CA; Westinghouse Electric Corporation, Pittsburgh, PA; and University of Illinois, Urbana, IL. In total there are 75 contractors with 136 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Increased insight has been obtained into creep-fatigue interactions in gas turbine engine disk materials. Experimental data has indicated that during sequential periods of fatigue and creep, creep crack growth is accelerated by prior fatigue damage; however, fatigue crack growth is moderately decreased by prior creep damage. This information will help to provide guidelines for life prediction of engine disks. (2) A method of refining the grain size of 7075 aluminum has been developed which produces grain sizes down to 10 microns while holding other metallurgical variables constant. Excellent corrosion resistance results while tensile and fatigue properties remain similar to commercially available values for the peak strength condition. (3) Research on improving the high temperature characteristics of ceramics has resulted in a doubling of the strength of silicon nitride (Si_3N_4) together with improved fracture toughness through an oxidation treatment that was predicted from a theoretical study of the phase diagram of the ceramic system. Potential applications include ceramic turbine engines for cruise missiles and remotely piloted vehicles. (4) Research on non-destructive evaluation of composite materials has identified a method of detecting internal delaminations using an X-ray measurement of stress which occurs at the edges of the internal voids. (5) A

Project: #2306

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Materials

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

technique for producing very high transmission optical integrated circuits has been found by diffusing metallic ions into glass substrates to form infrared waveguides. The process is compatible with the low cost production techniques used in the integrated circuit industry.

2. (U) FY 1981 Program: Technical emphasis is being placed on structural materials, environmentally resistant materials, electromagnetic materials, and non-destructive evaluation. Research in structural materials is emphasizing titanium and nickel based alloys of importance to turbine engines and aluminum alloys for airframes. Environmentally resistant materials research is investigating ceramic coatings to improve the oxidation and corrosion resistance of high temperature turbine metals, erosion resistant and ablative materials for missiles and rockets, and laser hardened optical components. Electromagnetic materials research includes efforts on compound semiconductor growth and characterization, acoustic and magnetic materials for analog signal processors, superconductors for power generation and transmission, optical and infrared glasses and crystals for detectors and fiber optics, and ultrahigh purity quartz for time and frequency standards. Non-destructive evaluation research is emphasizing fundamental knowledge of ultrasonics for flaw detection in metals, ceramics, and laminated composites.

3. (U) FY 1982 Planned Program: Research for FY 1982 will investigate materials with potential for improved high temperature gas turbines and airframe components and also the electronic materials needed for improved signal generation, detection, and processing. The programs in non-destructive evaluation and powder metallurgy will continue with moderate expansion. Synthesis of high temperature superconductors for advanced electrical power systems will continue at existing levels. Research in synthesis and characterization of gallium arsenide will be progressively redirected from solid state microwave components to digital signal processing. Research in optical storage, optical processing and electro-optics will be increased. Submicron electronic materials science will receive increased funding.

4. (U) FY 1983 Planned Program: The Air Force materials research program for FY 1983 will continue to support the technologies vital to reliability and advanced performance of Air Force equipment. The synthesis and characterization of metals and ceramics promising long life time and a high degree of resistance to high temperature and corrosive environments will be supported. Semiconducting, superconducting and acoustic materials research will continue as a basis for components with enhanced performance and high reliability to meet the communications and power handling requirements of Air Force systems. Funding emphasis will continue to be placed on powder metallurgy, joining and forming, non-destructive evaluation and submicron electronic materials science.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2306

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Materials

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	15,735	16,640	18,010	23,700	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	16,200	19,670	23,600	Continuing	Not Applicable
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The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$147.2 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$5,590 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate was accomplished by restricting research increases planned primarily for synthesis and characterization of electronic materials and by postponing expansion of research in powder metallurgy.

Project: #2307

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Mechanics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Mechanics research provides fundamental knowledge pertaining to aerodynamics and structural principles required for improving the efficiency, effectiveness, and safety of current and future Air Force aerospace vehicles, and civil engineering technology for field installations. Investigations are conducted in fluid mechanics, solid mechanics, flight dynamics, and soil and field structure mechanics. The results of this work provide the generic aerodynamic and structural technologies with new insights and concepts necessary to assure the design and production of superior aerospace weapon systems and installations.

(U) RELATED ACTIVITIES: Department of Defense topical reviews and the Technical Coordinating Paper on Structures published by the Under Secretary of Defense for Research and Engineering provide overviews of the mechanics research of the three services. Overall project coordination takes place in annual triservice reviews. Meetings of special interest are also held involving the National Aeronautics and Space Administration; Army Research Office; Army Materials and Mechanics Research Center; Office of Naval Research; National Academy of Engineering, as well as with universities and industry.

(U) WORK PERFORMED BY: In-house research in mechanics is now underway at the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Frank J Seiler Research Laboratory, USAF Academy, CO; Air Force Armament Laboratory, Eglin AFB, FL; Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; and Air Force Weapons Laboratory, Kirtland AFB, NM; and will begin at the Air Force Engineering Services Center, Tyndall AFB, FL in FY 1982. The ten major contractors are: Massachusetts Institute of Technology, Cambridge, MA; California Institute of Technology, Pasadena, CA; Princeton University, Princeton, NJ; Texas A&M, College Station, TX; Stanford University, Stanford, CA; University of Texas, Austin, TX; Systems Research Laboratories Inc., Dayton, OH; University of Washington, Seattle, WA; Georgia Institute of Technology, Atlanta, GA; and University of Pittsburgh, Pittsburgh, PA. In total there are 88 contractors with 138 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Small perturbation theory has been successfully applied to transonic (nonlinear) flowfields thus allowing more rapid accurate aerodynamic computation. The method can be used to obtain solutions for small changes in flight conditions. (2) Accurate computational results have been obtained for oscillating supersonic flow past a spike-tipped, blunt body, relevant to reentry bodies. Such numerical solutions of the exact flow equations are useful for investigating a large class of self-excited, unsteady viscous flows of practical interest. (3) A method has been developed for the rapid prediction of flows in two dimensional diffusers. It is accurate for the full range of probable flow conditions including unstalled, transitory stalled and fully stalled flow. (4) Experimental observations of the structure of turbulent boundary layer flow indicate that ring vortex interactions with the surface may give rise to the major component of turbulent drag. (5) A nonlinear viscoelastic constitutive law has been developed which accurately predicts time-dependent failure mechanisms of adhesive joints and advanced composites. (6) A viscoelastic analysis for accurate residual stress and failure prediction due to environmental conditioning of graphite/epoxy composites has been developed and experimentally verified.

Project: #2307

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Mechanics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Research in transonic and nonlinear supersonic aerodynamics is continuing with increased emphasis on three-dimensional aspects and shock wave-boundary layer interactions. Work related to transonic wind tunnel wall interference is being decreased. Complex flow fields characteristic of those found in advanced turbomachinery are being examined both theoretically and experimentally. A new research program directed toward induced unsteady separated flows is being initiated. The description and characterization of the physical mechanisms governing the turbulence production process in shear flows remains as an area of emphasis. Efforts exploring nonlinear structural analysis will be stressed. Integrated research on processing, testing, environmental effects, fatigue, fracture, and modeling for structural design of metals and composites are continuing. Research in geotechnical material mechanics is emphasizing electro-mechanical modeling of piezoresistance materials to relate changes in material resistivity to complex, three dimensional states of stress. Fracture mechanics concepts are being applied to plain and reinforced concrete construction materials as a first attempt to understand and mathematically model yield and failure of such complex composites subjected to realistic states of stress.

3. (U) FY 1982 Planned Program: Two new major thrusts will be initiated to address the aerodynamics of fuel efficient aircraft (totaling \$2.1 million) and the aerodynamics of low speed take off and landing (totaling \$1.2 million). The research program directed at fuel efficient aircraft technology will incorporate efforts in friction and form drag reduction, lift and thrust enhancement from unsteady, large amplitude wing motions, and active controls. In the low speed take off and landing area, the research program will focus on the interactions of high energy, propulsive jets with surfaces; the aerodynamic interactions of propulsive lift jets; mixing of co-flowing turbulent streams; and the aerodynamics of axial flow compressors. Some change of emphasis in the turbulence research program is anticipated as activities shift to the mathematical modeling of the organized flow features studied during prior experimental investigations. Research in computational grid generation for complex geometries and in unsteady, large scale flow separation will be expanded. Highly deflected, energetic jets characteristic of vertical/short take off and landing aircraft will also be investigated at an accelerated pace. Computational methods for flows through geometrically complex passages and studies of time dependent flows in axial flow compressors are expected to dominate the internal aerodynamics program. New activity is planned to explore aerodynamic heating on wing-store geometries in supersonic streams. The solid mechanics program will be restructured to emphasize five areas: design methods, dynamics, aeroelasticity, structural concepts, and durability. The dynamics and aeroelasticity efforts will grow and durability (fatigue and fracture) will decrease, although it will still be nearly half of the program. New efforts to develop turbomachinery deflection predictions and wing-with-stores flutter analysis will be initiated. Studies of piezoresistance gauge-matrix interaction will expand to develop gauges capable of measuring in-situ stresses in soil masses. Efforts to model the constitutive properties of geotechnical materials will include the response to three dimensional states of stress arising from nuclear and conventional detonations. Theoretical and experimental modeling of plain and reinforced concrete will emphasize the mechanics of steel-concrete interaction. Analytical models to mix these components will be developed. Studies will be initiated to develop constitutive relations for materials for alternate launch and recovery surfaces. These studies will provide the basis for design of unconventional airfield pavements which support immediate aircraft operations after attack with nonnuclear munitions.

Project: #2307

Program Element: #61102F

DOD Mission Area: Defense Research, #510

Title: Mechanics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

4. (U) FY 1983 Planned Program: In fluid mechanics, research in the transonic regime should focus on three-dimensional flows with strong shock waves and significant viscous interaction effects. Increased emphasis is anticipated on research into the mixing processes of co-flowing, turbulent streams and, in particular, of multiple jets in confined regions. Depending on results, the thrust of the turbulence program could shift from experiments to modeling. In the continued exploration of computational grid generation procedures, emphasis will be on adaptive grids which maintain the most dense portions of the grid in regions of large gradients as the solution evolves. In solid mechanics, emphasis will be on the iteration logic of integrated design, dynamics of flexible structures, and durability of composites. In civil engineering, theories will be developed which accurately predict the response of geotechnical materials to complex stress paths such as result from multiple nuclear detonations. Mathematical models will account for plastic flow, shear-volumetric coupling, hysteretic effects and strain softening. Theories will be formulated which account for the transfer of free-field stresses and motions to Air Force strategic structures, thereby providing design and analytic tools to insure their survivability. The increased research emphasis devoted to technologies related to fuel efficient aircraft and low speed take off and landing will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in Thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Total Additional to Completion	Estimated Costs
RD&E Funds	16,928	17,390	22,530	28,700	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	16,500	19,770	23,700	Continuing	Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$147.2 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$1,170 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate was accomplished by reducing planned funding for the continuing program and starting the major new initiative/thrust in aerodynamics of low speed take off and landing at \$1.2 million.

Project: #2308

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Energy Conversion

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is concerned with combustion, detonation and propulsion. The areas in which new knowledge is being sought include: (1) combustion and ignition phenomena associated with rocket and aircraft engines, both present and future; (2) advanced diagnostics and instrumentation needed to advance propulsion, materials, and weapons technologies; and (3) solid and gaseous detonation mechanisms associated with advanced conventional weapons and with improved safety in the use of energetic materials. The goal is to reduce the cost and to increase the flexibility and effectiveness of future Air Force systems through the application of research results to the technologies of propulsion, power generation, and conventional weapons.

(U) RELATED ACTIVITIES: This research is actively coordinated within the Department of Defense by annual triservice reviews by the Under Secretary of Defense for Research and Engineering and within the Air Force through extensive participation of user organizations in both planning and evaluation. Coordination with other government agencies includes participation in such formal mechanisms as the Interagency Advanced Power Group and the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Propulsion Committee, as well as less formal but continuous contact with the National Science Foundation, the National Research Council of the National Academy of Science, and the Department of Energy.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Armament Laboratory, Eglin AFB, FL; the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA; and the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. The ten major contractors are: Princeton University, Princeton, NJ; Georgia Institute of Technology, Atlanta, GA; Atlantic Research Corporation, Alexandria, VA; Stanford University, Stanford, CA; Massachusetts Institute of Technology, Cambridge, MA; Purdue Research Foundation, Lafayette, IN; SRI International, Menlo Park, CA; Sheffield University, Sheffield, England; Jet Propulsion Laboratory, Pasadena, CA; and University of Illinois, Urbana, IL. In total there are 38 contractors with a total of 53 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) In air-breathing propulsion, a new correlation model was developed and experimentally validated which defines the regions of lean blowoff and stable flameholding in premixing/prevaporizing combustors. The correlation has provided guidance to combustion design and development engineers. It was found that using properly designed contoured swirlers, in place of existing flameholders and current volume-limited ramjet dump combustors, improved combustion efficiency and reduced total pressure loss by about 10% and also makes feasible the use of very short aspect ratio combustors. These improvements in combustor performance and more efficient packaging can result in over 50% increase in range over existing integral ram rocket configurations. (2) A new simple laboratory technique involving the measurement of the "sooting height" of a fuel burning in air was developed which was shown to be a measure of the pyrolysis of a fuel and its tendency to soot. Results from these experiments are used to guide fuel specialists in their choice of fuel constituent specifications. (3) In rocket propulsion, success was achieved with new methodologies for propellant burning rate response measurements; the methodologies for determining the frequency dependence of

Project: #2308

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Energy Conversion

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

propellant burning rates take advantage of recent advancements in instrumentation and offer the promise of greatly reducing the occurrence of rocket motor instabilities. (4) Experiments on the mechanisms of missile drag reduction by base/external combustion indicate that important increases in missile range can be achieved using properly configured fuel injection systems. (5) In the area of fuel air explosives, a new theory has been developed and experimentally validated which predicts the minimum size of unconfined fuel-air cloud capable of initiation and sustaining detonation. Also, recent experiments have conclusively demonstrated that "shockless" direct initiation of unconfined fuel-vapor-air clouds can be obtained by free radical seeding and turbulent mixing. These results are being used in the evaluation of the feasibility and practical utility and design and development of an advanced fuel air explosive weapons concept without the requirement for a high explosive ignition source and in development of techniques for prevention/minimization of damage from accidental fuel-air cloud formations.

2. (U) FY 1981 Program: A new interdisciplinary program on diagnostic methods and instrumentation applicable to reacting flows is underway. Also, additional emphasis is being placed on advanced diagnostics as part of the Air Force in-house laboratory programs. The dynamics of high-speed turbulent steady-state and transient chemically reacting flows are being investigated theoretically and experimentally. Research on the pyrolysis and oxidation kinetics of hydrocarbons is receiving additional support, with emphasis on representative aromatic hydrocarbon constituents of shale oil or coal derived future fuels. Research continues on exploring phenomena associated with undesired ignition from multiple sources. Research is being conducted on alternate means of ignition and flame holding for airbreathing engines. An increase in efforts pertaining to the combustion of alternative fuels and high-energy/high-density fuels (e.g., carbon and boron slurries), to ramjet combustion instability, and to supersonic and dual mode (subsonic and supersonic) combustion is being planned. The efforts associated with thermophysical and thermochemical property measurements and evaluation are being decreased. Efforts are continuing on particulate and soot formation and on other combustion generated exhaust emissions and plumes. Efforts are being initiated to explore the phenomena associated with rocket motor combustion to provide knowledge needed to improve performance and efficiency. Physical and chemical reactions in rocket plumes along with a number of radiation phenomena are being investigated. Efforts relating to rocket combustion dynamics are being emphasized. New efforts are being started to understand the processes required to rapidly and efficiently burn metal. The air breathing combustion program will expand efforts related to unconfined fuel-air explosions, especially as they address future conventional weapons.

3. (U) FY 1982 Planned Program: This will be the second year of the major research initiative on nonintrusive optical and acoustic techniques to obtain reliable experimental measurements of reacting and nonreacting flow parameters in combustors and augmentors and on the use of such data to validate and refine theoretical models. Attention will be given to advanced diagnostics for performing research on energetic materials, particularly condensed phase processes. This research is intended to provide diagnostic techniques which are essential to advance and understand combustion systems, air-breathing and rocket engines, effective fuel utilization, and exhaust plume signatures. Continuing theoretical and experimental research will be directed at the dynamics of high-speed turbulent steady-state flows and transient chemically reacting flows with emphasis placed on realistic modeling and characterization of the flow field, processes and phenomena occurring in dump-type ramjet, gas turbine, and ducted rocket combustors. Research will continue on ignition, combustion and flame stabilization enhancement with emphasis on phenomena associated with premixing/prevaporizing, catalytic and photochemical energy addition processes. The research on phenomena associated with undesired ignition from multiple

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Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Energy Conversion

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

sources will be assessed to define areas of emphasis. Attention will be given to establishing the research needs associated with the combustion of coal and shale oil derived alternative fuels and high-energy high-density fuels, ramjet combustion instability, and ducted rocket and supersonic/dual mode combustion. The advisability of funding a major, long term effort in advanced energetic materials for propellants will be explored by workshops, contractors, and Air Force laboratory experts. Propulsion concepts for efficient transfers from low earth orbit to higher orbits reviewed in the FY 1981 will become the subject of long term research programs. Efforts will continue to explore the phenomena associated with rocket motor combustion to provide knowledge needed to improve performance and efficiency of tactical, strategic and space propulsion systems. Physical and chemical reactions in rocket plumes along with a number of radiation phenomena will be studied in Air Force laboratories and through contract. Efforts relating to rocket combustion dynamics will continue to be emphasized with the long range goal of making a priori assessments of the likelihood of stable motor operation. This will be the second year of the research to understand the processes required to burn metal, in particular boron, in ducted and ram rockets fueled by either slurries or solid propellant gas generators. The research on condensed explosives will be unified under this task. Fuel air explosion research will be continued in anticipation of needs driven by developing conventional weapon systems.

4. (U) FY 1983 Planned Program: Some additional growth is expected in efforts pertaining to ramjet combustion instability, to ducted rocket and possibly to supersonic/dual mode combustion. Some growth is expected in efforts pertaining to the combustion of metalized fuels for air-breathing systems. Fuel-air explosion research will probably remain constant. Decisions whether to proceed with a major initiative on advanced energetic materials will be made.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in Thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
ROD&E Funds	7,464	8,780	9,640	12,200	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	8,500	10,490	12,360	Continuing	Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$2,720 thousand reduction in the FY 1982 estimate was accomplished by restricting earlier planned activity and growth in combustion of alternative fuels, undesired ignitions, detonation hazards of solid propellants, and propulsion concepts for transfer from low earth orbit.

Project: #2309

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Terrestrial Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports Air Force requirements in missile system guidance, control, and delivery; advanced guidance component testing; missile site selection; detection and identification of underground nuclear explosions; and surveillance. Research in geodesy is required to determine the exact position of targets with respect to missile launch silos. Research in gravity is required to determine its effect on missile guidance systems. Research in seismology is required to determine the effects of earthquakes, nuclear explosions, and other natural or system-generated noise on missile guidance systems degradation.

(U) RELATED ACTIVITIES: Complementary research is conducted by the Army, Navy, National Aeronautics and Space Administration, National Science Foundation, and the U.S. Geological Survey. Coordination with the Army and Navy is accomplished through the Environmental Sciences Technology Coordinating Paper and during Under Secretary of Defense for Research and Engineering annual reviews. Additional coordination is accomplished through interagency groups (e.g., the Interagency Geophysics Discussion Group) and scientific symposia.

(U) WORK PERFORMED BY: In-house research is now underway at the Air Force Geophysics Laboratory, Hanscom AFB, MA. The ten major contractors are: Systems, Science and Software, La Jolla, CA; University of Colorado, Boulder, CO; Boston College, Chestnut Hill, MA; Stanford University, Stanford, CA; University of Maryland, College Park, MD; Columbia University, New York, NY; Nova University, Fort Lauderdale, FL; Massachusetts Institute of Technology, Cambridge, MA; C.S. Draper Laboratory, Cambridge, MA; Ohio State University, Columbus, OH. In total there are 16 contractors with 19 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Air Force terrestrial sciences research has provided advances to support work in areas such as satellite radar altimetry, lunar laser ranging, development of absolute gravity measuring instrumentation, and techniques for combining various types of gravity data into earth gravity models which have enabled the Air Force to improve ballistic missile accuracies and to calculate precision orbits for military satellites. (2) Data from borehole tiltmeters and other near-surface geophysical instruments have been analyzed to determine tidal and long-period earth deformations, and an earthquake simulation code has been successfully used to predict far-field ground motions in specific regions of interest to the Air Force. These developments will aid greatly in the theory and data necessary to achieve the very high accuracy required in future intercontinental missile systems. (3) Baselines between Sweden, Massachusetts, West Virginia and California have been measured with accuracies of several centimeters by intercontinental interferometry, providing an unprecedented accuracy in the distance between the North American and European Continents thereby contributing to the knowledge of the earth model for both satellite orbit and targeting purposes. (4) Three prototype superconducting gravity gradiometers working on different principles of common mode rejection have been assembled and tested. The technology competition between these gradiometers will provide the technology base for measuring gravity and gravity changes to the extreme accuracy necessary for future missile systems.

Project: #2309

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Terrestrial Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Additional data from intercontinental radio interferometry and lunar laser ranging is being compared to improve the accuracy in determining the variations in earth rotation and polar motion. Theoretical and experimental studies are being started to develop new instrumentation for earth motion measurements. Improved knowledge of irregular earth rotation and polar motion are required to assess and test advanced inertial sensors for navigation and guidance. An improved gravity field model is required to meet the navigation and guidance accuracy requirements for the mid-1980s. Therefore the satellite-to-satellite tracking configurations and procedures for implementing a new global vertical datum are being analyzed, evaluated and integrated into the new gravity model. Research in seismology, seismic wave propagation and new instrumentation is being conducted to provide the necessary data to reduce the effects of spurious earth motions on advanced missile guidance systems. The third prototype cryogenic gravity gradiometer is being tested and used on an experiment to test the inverse square gravitation law at laboratory distances.
3. (U) FY 1982 Planned Program: To further improve the gravity field model, detailed geoid and earth gravity fields will be derived for selected geographical areas from satellite altimetric data; ocean and earth tide models will be studied to make tidal corrections to absolute gravity measurements; and phase differencing techniques will be applied to L-band satellite signals for making high precision geodetic measurements. New field measurements and computer simulations of earth motions in different geologic structures and over a wide range of frequencies will be continued to optimize navigation and guidance sensor test and evaluation procedures and enhance guidance system operational capacity in the terrestrial environment. Techniques will be further developed for predicting the nature and magnitude of ground motion (amplitude and frequency) which can be expected from earthquakes and distant nuclear attacks on land-mobile missile systems. Increased funding will be used to develop seismic ultrasonic techniques to test model materials matching typical earth properties in valleys selected for the MX missile system.
4. (U) FY 1983 Planned Program: The Air Force will participate in the international project on Monitoring Earth Rotation and Intercomparison of Techniques. Gravity field model improvements will be made possible by research programs in earth-to-satellite and satellite-to-satellite tracking techniques, satellite altimetry, mobile gravity gradiometry, geodesy theory and computer software and hardware. The evaluation of the cryogenic gravity gradiometer techniques will be completed and recommendations made as to system development transfer. Phase differencing techniques using satellite signals from the Global Positioning System will be the major means for making high precision geodetic measurements.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

Project: #2309

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Terrestrial Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	1,942	2,080	2,430	2,700	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	1,800	2,220	2,740		Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts.

Project: #2310

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Atmospheric Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The design and operation of Air Force aerospace systems are affected by such atmospheric properties as density, optical transmission, winds, temperature, precipitation and infrared emissions. The research program in atmospheric sciences involves the study of the earth environment from the earth's surface to satellite altitudes. Particular attention is focused on cloud and aerosol (e.g., haze, dust, etc.) properties impacting on optical and infrared weapons guidance and delivery systems, and on medium, or battlefield, scale weather prediction. Analyses of the dynamics and structure of the upper atmosphere and ionosphere are major research efforts directed at enhancing communications and surveillance systems capabilities.

(U) RELATED ACTIVITIES: Complementary research programs in atmospheric sciences are conducted by the Army, Navy, and other Federal agencies. Work is coordinated within the Department of Defense through triservice reviews, with other Federal agencies through the Committee on the Atmosphere and Oceans, and the Office of the Federal Coordinator for Meteorology.

(U) WORK PERFORMED BY: In-house research in atmospheric sciences is now underway at the Air Force Geophysics Laboratory, Hanscom AFB, MA. The ten major contractors are: Northeastern University, Boston, MA; Utah State University, Logan, UT; Massachusetts Institute of Technology, Cambridge, MA; Boston College, Chestnut Hill, MA; University of Missouri-Rolla, Rolla, MO; University of Massachusetts, Amherst, MA; University of California, San Diego, CA; University of Lowell, Lowell, MA; Space Vector Corporation, North Ridge, CA; Space Data Corporation, Tempe, AZ. In total there are 31 contractors with 41 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) In two separate field efforts during 1979 and 1980, mesoscale convective precipitation features (2-500 kilometers in extent) of Pacific cyclones and midwestern summer convective cloud masses were found to possess strikingly similar cell structure and behavior. Requiring substantive modifications to developed conceptual models, the new findings relate directly to current mesoscale modeling and numerical weather forecasting research efforts and are applicable to improved battlefield weather support. (2) Ice particle populations in high altitude clear air have been discovered which are suspected to be a potentially significant influence on the transmission of visible/infrared radiation through the atmosphere, the global energy budget, and communications and surveillance systems operating at visible or infrared wavelengths. (3) In an important advance to understanding the vertical coupling of atmospheric dynamics, data from the newly developed Mesospheric-Stratospheric-Tropospheric radar indicates that significant energy exchange occurs by vertically propagating internal gravity waves, and that this exchange can be initiated by common weather events such as thunderstorms. (4) Ionospheric research, critically important to the design and use of communications and surveillance systems, yielded, for the first time, cross-sections of ionospheric electron densities and charges that occur because of the sun's influence. These findings impact directly upon understanding why high frequency radio signals and satellite communications systems fade and strengthen and how they can be improved. In the area of spaceborne detection and surveillance, new infrared sources, such as excited carbon dioxide gas, and chemically formed ozone were identified as adding to the background against which long range infrared detectors must operate. Spectra of infrared emissions produced by collisions of hot rocket exhaust gas with atmospheric species were determined and will add to remote infrared detection and identification capabilities.

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Project: #2310

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Atmospheric Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Technical emphasis is focused on research in specific areas of meteorology and upper atmospheric physics: mesoscale meteorology (weather on the 2-500 kilometer scale), dynamics, cloud physics, ionospheric variability, and high altitude infrared radiation emissions. The mesoscale meteorology program to improve medium scale forecasting capabilities is continuing with both field programs and modeling efforts. Dynamic meteorology research is being upgraded to focus on the potential for superimposing finer-scale (mesoscale) forecasting models on hemispheric scale models to yield vastly improved forecasting capabilities in areas of strong Department of Defense requirements such as worldwide cloud forecasting. The cloud physics research program, focused on the development of a sophisticated cloud physics chamber, is being upgraded to include theoretical studies and software development. Ionospheric electron density structure and variation is being investigated by incoherent scatter radar systems, satellite sounding data, and radio signal scintillation data analysis. These efforts are directly usable by Air Force systems for surveillance, target detection and communications. In related work, laboratory and field measurements of optical/infrared emissions by atmospheric constituents, aurora, and airglow is continuing for improvement of radio and radar propagation models, optical/infrared backgrounds, and high altitude chemical composition.

3. (U) FY 1982 Planned Program: Mesoscale dynamics field experiments aimed at battlefield weather support will continue with emphasis on the interaction of the planetary boundary layer (the near-earth, friction dominated atmosphere) with the larger scale dynamics of cyclonic storms. Development of the cloud physics facility will continue with increased funding to support of parallel theoretical studies. Analysis of Mesospheric-Stratospheric-Tropospheric radar data will be emphasized with increased funding levels to study the dynamic links between the upper atmosphere and the atmosphere below 10 kilometers including the application of this technology to routine weather observation systems. Continued satellite, rocket, radar and laboratory experiments for improved knowledge of upper atmospheric chemical constituent, aurora and airglow radiative emissions will support development of increased sensitivities and sophistication of earth or space borne detection, surveillance and communications systems. Analysis of data from the joint U.S. - European "Energy Budget Campaign," to carefully document solar caused energy deposition in the ionosphere will be emphasized for application to refinement of models of ionospheric influence on communications and surveillance systems.

4. (U) FY 1983 Planned Program: With the completion of the cloud physics chamber facility in late 1982, in-depth cloud particle physics research applicable to aircraft icing studies and optical/infrared/microwave propagation will receive coordinated multi-agency funding. A multi-year joint program by U.S. and European scientists to further basic understanding of the vital but little known middle atmosphere, 10 to 100 kilometers altitude, will be vigorously encouraged for eventual application to longer term weather forecasting support worldwide as well as improved ionospheric behavior forecasting. Efforts in mesoscale meteorology will enter a new phase, with support being given to a national program to investigate geographic similarities and differences in cyclonic storms and the applicability of accepted mesoscale and larger dynamics models to improved forecasting capabilities.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2310

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Atmospheric Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	7,344	7,830	8,720	10,600	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	7,400	8,980	10,740	Continuing	Not Applicable
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The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$2,020 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate will delay studies in theoretical cloud physics and mesoscale meteorology.

Project #2311

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Astronomy and Astrophysics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Space environmental conditions produced by radiation and atomic particles can endanger the mission and degrade the performance of military spacecraft, disrupt the detection and tracking of missiles and satellites, distort communications and interfere with surveillance operations. This research project provides basic knowledge of the space environment for the design and calibration of advanced Air Force systems. The project also supports the Air Weather Service by improving observing and forecasting techniques that support operational military systems. Experimental and theoretical means are used to study: (1) methods to improve space surveillance systems; (2) solar outbursts and their travel to the earth where they affect communications and satellite systems; (3) composition of the space environment in which Air Force systems operate and changes caused by natural and man-made disturbances; and (4) the response of spacecraft systems and operations to the space environment.

(U) RELATED ACTIVITIES: The Navy, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, and National Science Foundation are conducting/sponsoring complementary research. Coordination is accomplished through the Environmental Sciences Coordinating Paper and during reviews by the Under Secretary of Defense for Research and Engineering. Cooperative programs include Air Force and National Aeronautics and Space Administration particle sensors flown on Air Force satellites and quarterly Space Forecasting Workshops to support Air Weather Service requirements.

(U) WORK PERFORMED BY: In-house research in astronomy and astrophysics is now underway at the Air Force Geophysics Laboratory, Hanscom AFB, MA. The ten major contractors are: Emmanuel College, Boston, MA; Regis College, Weston, MA; University of California, LaJolla, CA; Rice University, Houston, TX; University of Arizona, Tucson, AZ; University of Utah; Salt Lake City, UT; Johns Hopkins University, Laurel, MD; Environmental Research Institute of Michigan, Ann Arbor, MI; Analytic Data Processing, Danville, CA; and Louisiana State University, Baton Rouge, LA. In total there are 31 contractors with 36 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Two significant influences on solar particle events, which can disrupt the near-earth space environment and degrade defense satellite operations, have been identified and analyzed. (2) High resolution satellite measurements have been made of electric and magnetic fields in the polar regions, which can affect the performance of communication and surveillance systems. (3) A new technique, which will contribute to ground based optical surveillance systems, was used to obtain size and shape data of a Russian satellite. (4) The first stage has been completed of a program to select faint stars for use in calibrating deep space surveillance and detection systems.
2. (U) FY 1981 Program: Imaging techniques are being developed for observation of solar disturbances and for application to space object observations and measurements of spacecraft parameters for surveillance and tracking. Studies of solar characteristics are being directed towards the detection of solar variability and the prediction of solar flares, which propagate to the earth and effect Air Force communication systems and the charged particle environment in which Air Force satellites operate. New theoretical techniques coupled with improved data reduction methods are being used to predict the

Project: #2311

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Astronomy and Astrophysics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

time and intensity profile of solar proton events, which degrade Air Force communication and satellite systems. Satellite data on the charged particles in space is being analyzed to model the dynamics of the ionosphere and magnetosphere to understand and predict radio and radar propagation problems and to improve the reliability of Air Force space systems.

3. (U) FY 1982 Planned Program: Satellite data will be used in conjunction with ground-based data from auroral zone and polar cap stations to investigate energy transfer processes and coupling phenomena between the magnetosphere and the space environment in which Air Force satellite systems must operate. A digital mapping method for high-speed transmission of solar flare data will be implemented for the Air Weather Service Solar Optical Observing Network. Imaging techniques will extend the detection limit and data quality for faint space object observations to be applied to the identification, surveillance and tracking of satellites and spacecraft. Measurements and models of the entrance and deposition of high energy charged particles in the near earth space environment will be made for use in the specification and prediction of storms in space which degrade Air Force communication and satellite systems. The interaction of large space structures and the space environment for future Air Force surveillance and communication systems will be studied.

4. (U) FY 1983 Planned Program: High resolution systems for observing solar activity and magnetic fields will be installed and tested to aid in developing models of solar flares, whose effects disturb communication and satellite systems. Satellite data will be analyzed to define and model the density, temperature, composition and fluctuations of electrons and ions, which affect Air Force radio and radar propagation. The Long Duration Environmental Exposure Package will be flown on the Space Shuttle to obtain data to mitigate adverse effects from the space environment on Air Force spacecraft. Studies of celestial background radiation and imaging from ground based telescopes, which affect the detection and surveillance of space objects, will continue. The study of the space environment and large space systems will be expanded in order to reduce adverse interaction effects on Air Force operations.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in Thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E Funds	4,609	4,710	5,220	6,300	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	4,400	5,340	6,280		Continuing	Not Applicable

Project: #2311

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Astronomy and Astrophysics

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$1,060 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate was accomplished by restricting earlier planned growth in magnetospheric, solar and stellar physics.

Project: #2312

Program Element: #61102F

DoD Mission Area: Defense Research, #510

Title: Biological and Medical Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides fundamental knowledge in biotechnology required in the development and operation of effective manned weapon systems. Toxic materials such as Air Force unique fuels and propellants as well as electromagnetic radiations are studied to assess their potential hazard and to devise corrective measures. Research in physiology and biomechanics provides knowledge for improving personnel protection and performance in varied stress environments encountered during flying. Research in aerospace medicine provides the basis for selection, retention, health maintenance, and projections of career expectancy of Air Force personnel. Biological research seeks knowledge of natural analogs of command, control, and communications systems which may lead to new technologies or models. Research is conducted in environmental quality to assess, measure, and control Air Force generated pollutants to meet national environmental concerns while maintaining operational flexibility. A planned funding increase will enable a thrust in the physiology and biochemistry of chemical warfare agents and antidotes to begin in FY 1982.

(U) RELATED ACTIVITIES: The Air Force Biological and Medical Sciences program is coordinated through several interagency panels and groups which include participation by the Army, Navy, Federal Aviation Administration, National Aeronautics and Space Administration, Defense Advanced Research Projects Agency, Environmental Protection Agency, National Institutes of Health, Food and Drug Administration, and Department of Agriculture. Coordination is also achieved through the Technical Coordinating Paper on Medicine and Biological Sciences of the Undersecretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: In-house research in the biological and medical sciences is now underway in-house at the Air Force School of Aerospace Medicine, Brooks AFB, TX; the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH; and the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. The ten major contractors are: Ohio State University, Columbus, OH; University of Kentucky, Lexington, KY; University of California, Los Angeles, CA; Georgia Institute of Technology, Atlanta, GA; University of California, San Francisco, CA; University of California, Santa Barbara, CA; Monsanto Research Corporation, Dayton, OH; University of Rochester, Rochester, NY; University of Texas, Austin, TX; and University of California, Irvine, CA. In total there are 44 contractors with 66 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Research on the effects of Air Force chemicals on human cells in culture have demonstrated that many chemical effects found in the human cell assay system differ from results in rodent systems. The results of this research open to question the validity of current data based on rodent studies and will provide better extrapolation of laboratory studies to humans. (2) Studies on the effects of various hydrazines in immune response have demonstrated a loss of regulatory cell (T-cell) function. Such a loss of T-cell function could result in a high incidence of autoimmune disorders, as well as increased susceptibility to infections and neoplastic diseases. (3) A breakthrough has been made in attempts to determine early indicators of latent toxic effects of Air Force chemicals. Carcinogen treated hamsters demonstrate a decrease in a specific chromatin-binding biochemical long before tumors form. When validated, this technique should significantly reduce the time and cost of testing for chemical carcinogenicity. (4) Research on the effects of microwaves on thermoregulation have demonstrated that during a 90 minute exposure to 10 milliwatts/square centimeter the metabolic rate is efficiently moderated as heat is deposited in the body so that deep body temperature remains unchanged. (5) Investigation of the effects of microwaves on excitable membranes revealed that the average interbeat interval of cardiac cell aggregates decreased for specific absorption rates greater than 4

Project: #2312

Program Element: #61102F

DDO Mission Area: Defense Research, #510

Title: Biological and Medical Sciences

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

milliwatts/gram. Such alterations in cardiac function may be of significant detriment to personnel working in stressful environments. (6) Studies in environmental physiology indicated that body position and level of exercise affect the volume of plasma that is circulating in the blood vessel system. (7) A series of elegant experiments on a group of cells in the brain that control circadian activity (body clock) has revealed that this activity can be adjusted by physical and pharmacologic means. This alteration of the body clock could form the basis for longer phase shifts that could compensate for changes due to operational environments. (8) Vertebral bone strength was demonstrated for monkeys, baboons, and chimpanzees, and an intradiscal pressure measurement technology was developed. These accomplishments and the interspecies scaling relationship will form the basis of advanced mathematical/computer models of injury prediction for the human spine in aircrew members subjected to high velocity impact. (9) Research on single cell activities within the brain have shown biochemical pathways that result in increased gain (volume control) in individual cells. This biochemical means used by nerve cells to speed up or slow down information transfer is the first step in defining the basis of an adaptive computer component that could be useful in advanced information transfer systems.

2. (U) FY 1981 Program: Efforts have been increased to define and validate reliable subjective means for measuring fatigue and performance quality during Air Force operations. Pulmonary physiology studies are seeking to define the detrimental cellular effects of high intensity accelerations and high oxygen tensions. Emphasis is being placed on definition of brain center control of lung, heart, and blood vessels. A new thrust identifies the adaptive and information processing mechanisms used by living nerve cells to determine if such mechanisms can be used to design advanced information processing systems for applications in avionics; decision making; and command, control and communication activities. Fundamental biomaterials data is being collected for the neck region to provide additional information for predictive models of head, neck, and spine injury from impact. Work is continuing to define the effect of visual/motion environments on human performance and increased efforts are being made to investigate the efficacy of viable countermeasure techniques to defeat or degrade the human visual target tracking apparatus. The studies on stress-related hormones associated with coronary heart disease and the cellular damage associated with sleep deprivation are being completed. Studies to determine the mechanisms of interactions of electromagnetic radiation with biological systems is being emphasized. New efforts have been initiated to develop early biochemical indicators of latent toxic effects of Air Force chemicals. Research is underway to determine the effects of biorhythm disynchrony on toxicity and immune response to environmental chemicals. Work continues to determine the environmental fate and biological consequences of Air Force chemicals. Research directed toward the development of biochemical countermeasures against toxic agents is being pursued. A new program to determine pharmacokinetic parameters of Air Force chemicals and their metabolites has begun. Studies on cellular mechanisms of toxic action continue to receive strong emphasis.

3. (U) FY 1982 Planned Program: A major thrust (totaling \$2.0 million) will be initiated to study the basic physiology and biochemistry of chemical warfare agents and antidotes in order to provide novel prophylactics and therapy for personnel. A major component of this new program will be the investigation of synthetic receptors for chemical warfare agents. Toxic hazards research will be expanded to include a new thrust aimed at elucidating the mechanisms of toxic action of new Air Force synthetic fuels. Studies on the basic interaction of toxic chemicals and electromagnetic radiation with biological tissues will continue to receive emphasis. The work on nerve cell information processing will

Project: #2312

Program Element: #61102F

DOD Mission Area: Defense Research, #510

Title: Biological and Medical Sciences

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Budget Activity: Technology Base, #1

be expanded to include the study of nerve cell networks and goal seeking behavior in higher level organizational units in the nervous system. Efforts will intensify to define those material properties of bones, joints, and ligaments that are not known so that predictive models of impact injury may be refined and validated. An effort will be made to quantify the effects of specific laser exposure variables on flash blindness duration, and an electrophysiology program will be initiated to develop enhanced analytic techniques for the assessment of physiologic responses to operationally induced pilot workload.

4. (U) FY 1983 Planned Program: While maintaining a vigorous program in neuronal information processing and biomechanics, a new effort will begin to characterize the neurochemical receptors present in lung tissue and to delineate their pathways to the respiratory center in the brain. Fundamental knowledge of discrete pulmonary function at the cellular level is vital for future protective measures against chemical warfare agents and for advanced life support systems in high performance air and space craft. A major new thrust will be initiated to investigate the effects of low dose chemical warfare agents and agent antidotes on behavior and performance. A strong program in environmental toxicology will be expanded with emphasis on metabolic processes and pharmacokinetics.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>	
RD&E Funds	5,298	5,750	8,380	10,100	Continuing		Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	5,400	6,550	7,900		Continuing		Not Applicable

The FY 1981 budget data was based on a total funding level for the program of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million, with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$480 thousand increase in the FY 1982 estimate compared with last year's FY 1982 estimate will provide part of the additional funding for the major new initiative/thrust (of \$2.0 million) in chemical agent defense.

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Project: #2313

Program Element: #61102F

DOD Mission Area: Defense Research, #510

Title: Human Resources

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides the knowledge required to insure that Air Force personnel are fully prepared to develop, operate, maintain, and manage current and future weapons systems. Specific objectives include: establishment of an improved manpower and personnel system, advanced education and training methods, and definitions of the role of the operator in the design and operation of increasingly complex operator-machine systems. Research is conducted to characterize and predict human capabilities relative to military occupational requirements, to define demographic characteristics of the future Air Force manpower pool, and to define physical standards for Air Force occupations. Research on new training technologies and on the design of systems, displays, and controls will improve operational efficiency and reduce the life-cycle cost of aeronautical systems. Major concentrations of efforts are allocated to the following areas: (1) evaluation of demography and basic human abilities, (2) quantitative measures of workload, (3) human operator performance requirements in advanced aerospace systems, (4) studies to advance the use of simulation in flying and technical training, (5) visual processing in simulation training and in system design, and (6) information processing/decision aiding in command and control contexts.

(U) RELATED ACTIVITIES: The Air Force Human Resources program is coordinated through several interagency panels and groups which include participation by the Army, Navy, Federal Aviation Administration, National Aeronautics and Space Administration, and the Defense Advanced Research Projects Agency. Coordination is also achieved through the Technical Coordinating Paper on Human Resources of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: In-house research in human resources is now underway at the Air Force Academy, Colorado; the Air Force Human Resources Laboratory, Brooks AFB, TX; and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB, OH. The ten major contractors are: Virginia Polytechnic Institute and State University, Blacksburg, VA; Perceptronics, Inc., Woodland Hills, CA; Texas Tech University, Lubbock, TX; University of Illinois, Urbana-Champaign, IL; Dalhousie University, Nova Scotia, Canada; Massachusetts Institute of Technology, Cambridge, MA; University of California, San Diego, CA; New York University, New York, NY; Northwestern University, Evanston, IL; and Purdue University, West Lafayette, IN. In total there are 45 contractors with 60 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) Progress has been made in understanding the relationship between fidelity of a flight simulator and its value as a trainer. Understanding this relationship has important implications for economical simulator design. Related work has determined better ways to use sophisticated simulators for teaching critical combat skills. (2) Research on the decision making process of experts has suggested more effective ways to teach beginners. This research has also offered insight into the differences in reasoning between computers (artificial intelligence) and people. Based on such models of information processing, procedures to aid tactical decision makers have been developed. (3) In research on the human visual system, the neural mechanisms underlying the visual perception of motion have been more precisely described. Also, a procedure has been developed which will reduce the effects of uncertainty in detecting a moving target. Related work has established the relationship between the amount of visual information available to an experienced pilot in a simulator and his accuracy in landing maneuvers. (4) Shortcomings in traditional measures of visual sensitivity have been documented in laboratory experiments. (5) Progress has been made in

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Program Element: #61102F

DDO Mission Area: Defense Research, #510

Title: Human Resources

Title: Defense Research Sciences

Budget Activity: Technology Base, #1

representing complex physical relationships as elements in novel computer-generated visual scenes, and tests will determine if these are potent learning aids. Some of the principles of visual perception have been translated into a format better suited to designers of man-machine systems. (6) A new methodology has been developed which is particularly effective in incorporating human factors data into systems design, for example the design of the MX missile system.

2. (U) FY 1981 Program: Experiments are continuing to measure and code brainwave responses and related physiological activity in the search for biocybernetically based measures of workload performance. The coupling of such activities to man-machine systems in computerized adaptive feedback models should improve both the design and operation of these systems. A new research program is studying the learning abilities of enlistees to predict their adaptability and trainability in various Air Force occupations. Research on human learning is studying new practice environments for complex skills. These new environments will be candidates to replace traditional practice settings which will become too costly or impractical for training in the future. In the vision area, research is continuing to expand the data base necessary to establish new occupational vision standards. Research is also underway to describe the nature and limitations of neural mechanisms responsible for Air Force relevant types of visual information processing. Related research specifies the constraints imposed on visual information processing by nonsensory factors such as attention, memory and eye movements.
3. (U) FY 1982 Planned Program: The FY 1982 program will be marked by a major additional thrust in visual interactions which will integrate earlier work on single neural mechanisms and explore their mutual interactions in complex visual functioning. This is particularly relevant to cases involving dynamic motion and those involving optimum display configurations. Also during this period three in-house laboratory facilities will accelerate their efforts in (1) nonlinear approaches to object recognition and identification, (2) mini-learning tests as predictors of on the job success for new recruits, and (3) texture generation methods for building economical surfaces in computer generated display systems (such as simulators). This program will also include continuation of some FY 1981 efforts, specifically those directed toward (1) improving our understanding of visual scene requirements for flight simulation, (2) the sensory and perceptual factors important in the learning of aircrew skills, (3) the development and application of biocybernetic technologies to training systems and the design and operation of complex operator-machine systems, and (4) the improvement of operator-computer interactions.
4. (U) FY 1983 Planned Program: The vision research program will be redirected to concentrate on coupling models of neural processing developed earlier with computer moderated "visual" sensors. This is a logical merging of the laboratory research programs and university/industry research. This merger should result in experimental efforts directly confronting the problem of developing robotic visual systems as well as creating new approaches to interactive visual displays.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

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 Title: Human Resources
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7. (U) Resources: (\$ in Thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RD&E Funds	5,662	5,590	6,450	8,100	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>	5,800	7,160	8,500		Continuing	Not Applicable

The FY 1981 budget data was based on a total funding level for the program element of \$134.1 million for FY 1981 and \$159.9 million for FY 1982. The current FY 1982 project funding estimate is based on a program element funding request of \$142.7 million with a redistribution between projects to provide funding for new major initiatives/thrusts. In this project, the \$2,050 thousand reduction in the FY 1982 estimate compared with last year's FY 1982 estimate was accomplished by restricting earlier planned growth in the complex learning area; experimental work on synthetic learning environments will be deemphasized.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 62101F

DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics

Budget Activity: Technology Base #1

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	28,400	31,100 *	35,100	42,900	Continuing	Not Applicable
06DK	Laboratory Operations	17,247	16,458 *	17,921	18,310		
4643	Aerospace Radio Propagation	1,500	1,800	2,100	3,000		
6670	Meteorological Development	1,500	1,600	1,900	2,700		
6687	Stratospheric Environment	800	850	1,000	1,600		
6690	Upper Atmosphere Technology	1,300	1,400	1,600	2,400		
7600	Missile Geophysics	500	750	900	1,300		
7601	Magnetospheric Effects on Space Systems	1,000	1,100	1,600	2,600		
7659	Aerospace Probes	700	742	779	1,090		
7661	Spacecraft Charging	1,300	1,700	2,400	3,800		
7670	Infrared Properties of the Environment	2,553	4,700	4,900	6,100		

* Excludes October 1980 Civilian Pay Raise.

(U) BRIEF DESCRIPTION OF ELEMENTS AND MISSION NEED: To develop the technology necessary to specify and predict those geophysical phenomena (e.g., earth motions, weather, optical infrared backgrounds, ionospheric scintillations, upper atmosphere density) which impact on the capability of proposed or existing Air Force systems and operations (e.g., missile guidance systems, aircraft launch and recovery operations, surveillance satellite systems, communications satellite systems, space vehicle tracking systems). The technology developed will assist Air Force system designers and operators in mitigating as well as exploiting, where possible, the effects of the geophysical environment. This program also provides for the operation and management of the Air Force Geophysics Laboratory, Hanscom AFB MA.

(U) BASIS FOR FY 1982 DESCRIPTIVE SUMMARY: Provides funds to investigate those elements of the geophysical environment critical to the successful design, deployment and operation of Air Force weapons systems. The FY 1982 request includes two new programs. (1) Spacecraft Environmental Interactions Technology. Exploitation of space for military purposes will increase in the shuttle era where large, high-power space systems will be deployed. This new program will determine the physical processes and coupling mechanism by which the space environment could act to limit the operation of future large high-power satellites. One part of the effort will be the determination of the interaction of the Space Shuttle reentry zone which differs from the National Aeronautics and Space Administration's reentry zone. This effort is directed toward insuring that new expensive systems are not deployed in space with a catastrophic environmental failure mode engineered into the basic design. (2) Particle Beam Technology. Under this new program, spacecraft-borne charge ejection systems and accompanying theory will be developed for studying charged particle beam emission from spacecraft and beam propagation in

Program Element: #62101F

DOD Mission Area: Environmental and Life Sciences, #522

Title: Geophysics

Budget Activity: Technology Base #1

space. As a first step under this effort, a rocket payload will be built to study the propagation of charged particles in the space environment, in order to fill the technology base gap in understanding the propagation on low power, low energy beams in space. The technology base does not exist for understanding the propagation of charged particle beams in space.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
		Estimate	Estimate	Estimate	to Completion	Estimated
						Costs
RDTE	27,600	32,100	35,400		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable

Program Element 62101F

DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop the technology needed to assist Air Force and certain other Department of Defense system designers and operational decision makers in mitigating and/or exploiting the effects of the geophysical environment on existing, proposed, and future Air Force electronic, space missile, and aeronautical systems. Contrary to many held notions, many new sophisticated and complex systems are more sensitive to geophysical factors than systems being replaced. Because these geophysical sensitivities are often not adequately known until after system development or employment, and because of the lack of follow-on 6.3/6.4/6.5 program in most geophysics technology areas, this program element frequently provides direct input into today's rather than tomorrow's force readiness needs. This leads to efforts which are characterized as having finite lifetimes in response to immediate needs, rather than mainly level-of-effort programs. Examples of systems with geophysical dependencies are: increased Intercontinental Ballistic Missile accuracy is limited by incomplete knowledge of variations in gravity along missile trajectories; the preservation of location uncertainty for deployed MX missiles requires development of techniques to mask MX's seismic and other signatures; the use of directed energy weapons demands an exploration of the potentially adverse environmental interactions with high energy beams; the use of precision-guided munitions requires the development of techniques to predict battlefield weather elements not currently observed or predicted; the optimum design of infrared surveillance and space defense systems requires detailed atmosphere and celestial background infrared emission data; improved radio frequency communication and surveillance systems demand greater capability to specify and predict, on a global basis, fluctuations that occur in the ionosphere; space vehicle orbit and reentry predictions are inaccurate due to uncertain variations in upper atmosphere density; operational satellites are damaged by energetic protons and electrons released in solar storms; and new airframes such as the cruise missile require an improved capability in aircraft icing prediction. To meet the increasingly stringent requirements for improved systems, i.e., greater reliability, higher accuracy and survivability, extended remote coverage and minimum life cycle cost, this program element provides the technology to address the geophysical environment as an integral and interacting part of the systems themselves. The program in geophysics is concentrated in five areas: Space Effects on Air Force Systems, Optical/Infrared Systems Technology, Upper Atmosphere Impact on Air Force Systems, Terrestrial Effects on Air Force Systems, and Weather Effects on Air Force Operations. This program element, in addition to being the primary technology base exploratory development effort in geophysics, provides technical support to other Air Force and Department of Defense agency programs and receives reimbursement for the services provided.

(U) RELATED ACTIVITIES: Programs in the broad area of geophysics are conducted by the Army and Navy and other non-military federal agencies such as the National Oceanic and Atmospheric Administration and the National Aeronautics and Space Administration. When applicable to Air Force requirements, information gathered by others is used in the Air Force program. In addition to such complementary programs, joint or coordinated programs are conducted with other agencies when mutual interests exist. The work within this program element is coordinated (1) at the annual triservice briefings to the Office of the Undersecretary of Defense for Research and Engineering during apportionment review, (2) through the National Aeronautics and Space Administration/Air Force Space Research and Technology Interdependence Working Group which meets semiannually, (3) with the National Oceanic and Atmospheric Administration and other federal agencies engaged in geophysical sciences through committees of the Federal Council for Science and Technology and the Federal Coordinator for Meteorological Services and Supporting Research, and (4) through working groups set up by Air Force Geophysics Laboratory such as in satellite meteorology. Examples of joint or coordinated programs are: Joint Doppler Operational Program, a program with the National Oceanic and Atmospheric Administration to develop techniques for using Doppler radar for reliable severe storm detection; Spacecraft Charging and Spacecraft Environment Interactions, joint programs with the National Aeronautics and Space Administration to determine causes and means of controlling undesired electrical charge buildups on satellites, and to develop environmental specifications for future large space structures; Atmospheric Transmission, a coordinated program with the Army and Navy to develop

Program Element 62101F

DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics

Budget Activity: Technology Base #1

the capability and the computer codes to predict the obscuring effect of the atmosphere on optically and infrared guided weapons; Intercontinental Ballistic Missile accuracy, a coordinated program with the Defense Mapping Agency to develop techniques and geophysical instrumentation to improve Intercontinental Ballistic Missile targeting accuracy; and Nuclear Weapons Effects, a program with the Defense Nuclear Agency to model the nuclear-disturbed environment.

(U) WORK PERFORMED BY: Work performed under this line item is conducted and managed by Air Force Geophysics Laboratory, Hanscom AFB MA. Off base field sites are: Sagamore Hill Radio Observatory, Hamilton MA; Weather Radar Site, Maynard MA; Weather Test facility, Otis AFB MA; Goose Bay Ionospheric Observatory, Goose Bay, Labrador; and Balloon Launch Detachment, Holloman AFB NM. There were approximately 80 contractors doing work under 128 contracts utilizing FY 1980 62101F funds. The 10 major contractors were: Utah State University, Logan, UT; Boston College, Boston MA; Systems and Applied Sciences, Riverdale MD; University of California, San Diego CA; Tricon, Cambridge MA; Northeastern University, Boston MA; SRI International, Menlo Park CA; Visidyne, Burlington MA; Emmanuel College, Boston MA; Panametrics, Waltham MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The National Aeronautics and Space Administration computer code used to predict, environmentally-induced, electrical charging of spacecraft was validated using Air Force Geophysics Laboratory data; the code can now be used by the Air Force Systems Command Space Division in spacecraft design. The impact on the ionosphere of a high-power neutral particle beam emitted from a space vehicle was investigated; this initial study showed that beam/ionosphere interactions may disrupt certain Air Force systems such as the Over-the-Horizon radar and communication systems. The Air Force Geophysics Laboratory developed and maintained, standard Department of Defense code for predicting transmission of optical/infrared wavelength radiation through the atmosphere was extended to millimeter wavelengths because of growing interest in this wavelength region for weapons guidance and detection systems; this standard code is in widespread use throughout other government agencies, industry, and the academic community. The highest power electron accelerator space experiment ever attempted was successfully conducted from a rocket platform; the benchmark data obtained will be the cornerstone of Defense Nuclear Agency's nuclear scenario Infrared background codes used for Department of Defense Systems and performance analysis. A long wavelength Infrared sensor was developed and successfully flown in a rocket to measure the diffuse zodiacal sky background; these measurements are a key element in the long wavelength infrared background data base required to develop a United States space defense capability. The Air Force Geophysics Laboratory devised two-frequency technique that accounts for ionospheric time delay in Global Positioning System transmissions and permits desired positional accuracy to be obtained, was verified during the Global Positioning System Initial Operational Test and Evaluation. Measurements of the rapid change in phase of radio frequency signals transmitted through the ionosphere were made in support of special high priority strategic programs; this marked the first time that such data were obtained across the polar region. Using its Airborne Ionospheric Laboratory and the Goose Bay Laborator Ionospheric Observatory, the Air Force Geophysics Laboratory implemented support of the Systems Performance Tests for the Over-the-Horizon surveillance radar system; the Air Force Geophysics Laboratory obtained data and environmental specification analysis are crucial to a go-ahead decision for operational use of the Over-the-Horizon Surveillance Radar System. The solar ultraviolet radiation reaching the Earth was determined over a full solar energy output cycle; this unique set of data, when utilized in computer calculations, will lead to improved spacecraft orbit prediction and radio propagation models. A field program obtained data which characterize for a typical MX valley, the ground propagation of MX-induced ground motions; these data will be used to determine methods for

masking MX's seismic signature. Phase II of the Automated Azimuth Measuring Systems upgrade was completed; the improved system is required to determine Earth motion rotational effects on Intercontinental Ballistic Missile guidance systems. The length of the baseline from Haystack Observatory MA to Onsala Observatory, Sweden was determined to centimeter accuracy by the very long baseline interferometry technique; this and other very accurate baseline measurements are required by the Defense Mapping Agency to authenticate the scale of the Department of Defense World Geodetic System. The third and final year of the joint Department of Defense, Department of Commerce, and Department of Transportation operational test of Doppler radar technology for severe storm identification was successfully concluded; this joint program has provided the technology base for the Next Generation Weather Radar Joint Systems Program Office's formulation of performance specifications for the new Doppler system. An efficient fast computerized approach was formulated for automatically identifying cloud types from a combination of visible and infrared images taken by the Defense Meteorological System Program satellites; these improvements in cloud type identification that result from this approach are essential to several classified high priority Department of Defense programs.

2. (U) FY 1981 Program: This program includes three major new thrusts. In Project 4643, as a result of recent environmentally caused degradation in Air Force Satellite Communication System, an intensified field measurements program will be initiated to define the latitudinal variation of such degradation as well as its dependence on solar activity. In the Project 7670, under the Cryogenic Infrared Radiance Instrumentation for Shuttle thrust, the fabrication of a high resolution infrared spectrometer will be completed. This spectrometer will be flown to characterize the Shuttle infrared sensor contamination environment, and to determine atmospheric infrared backgrounds as seen from space during the shuttle mission. In Project 7600, begin to measure naturally occurring background levels of seismic noise and magnetic fields to provide design data to ensure the Preservation of Location Uncertainty for MX. Properties of surface layers of designated MX valleys will be measured and earthquake and hostile environment seismic risk to MX will be determined in response to immediate System Program Office needs. Other major thrusts include: The formulation and testing of the techniques and relationships applicable to the operational prediction of weather parameters adversely impacting electro-optical systems performance against actual measured quantities. Airborne observations of Earth and atmospheric radiation backgrounds and target signatures at millimeter wavelengths will begin using a newly developed spectrometer in response to immediate weapons and surveillance system needs. A coordinated ground, aircraft, rocket, and satellite observation program will be conducted to determine the feasibility of specifying ionospheric structure by remote observation of ionosphere ultraviolet emissions. Measurements of aircraft icing will be made concurrent with conventional upper air atmospheric measurements to develop improved icing prediction techniques based on conventional data in support of cruise missile requirements. Spacecraft charging technology development will conclude with the delivery to Air Force Systems Command Space Division of a comprehensive specification of the space environment at geosynchronous attitude, a charging model to calculate spacecraft charging distributions, and a report on techniques for actively controlling charging by charged particle ejection. Detailed ionospheric assessments to understand radar performance will be made during the systems performance tests of the Over-the-Horizon surveillance radar system; this will effectively conclude this program element's support of this system. Other efforts will include: A new program to determine the feasibility of using modified Global Positioning System receivers for Earth surveying with an accuracy of 1 centimeter over baselines of up to 100 kilometers. Earth's space radiation belt models used in spacecraft design will be updated based on all latest available data and on increased understanding of physical mechanisms involved. Development of techniques to measure and predict the small scale atmospheric turbulence which adversely affects atmospheric laser beam propagation will be initiated. A Light Detection and Ranging system will be fabricated to remotely measure from a satellite, atmospheric properties such as density, cloud heights, aerosol structure required for supporting Air Force tactical and strategic systems. An advanced technology laser wind sensor and required software will be developed for the

real-time analysis and display of wind patterns and hazardous wind shears encountered during aircraft landing and takeoff operations. At the request of the Office of the Assistant Secretary of Defense (Installations and Logistics), MIL-STD-210B, Climatic Extremes for Military Equipment, which provides the environmental specification for all outdoor military equipment destined for worldwide use, will be expanded to provide specifications for designing equipment intended for regional rather than world-wide use.

3. (U) FY 1982 Program: This program includes the 1 Oct 80 Civilian Pay raise and the following two new major thrusts: In Project 7661 under Spacecraft Environmental Interactions Technology, the physical processes and coupling mechanisms by which the space environment could act to limit the operation of future large high power satellites will be determined. Under this new effort one facet will be to identify the interaction of the Space Shuttle with auroral zone electric fields in order to determine potential adverse effects peculiar to the Department of Defense Shuttle reentry zone which differs from the National Aeronautics and Space Administration's reentry zone. In Project 7601, under Particle Beam Technology, both spacecraft-borne charge ejection systems and accompanying theory will be developed for charged particle beam emission from spacecraft and beam propagation in space. As a first step under this effort, a rocket payload will be built to define the propagation of charged particles in the space environment, to fill the technology base gap in understanding the propagation of low power, low energy beams in space. Other major thrusts will include: Expanding the Department of Defense standard code which predicts atmospheric optical/infrared transmission to effectively handle scattering of solar and lunar radiation. An aircraft-carried sensor to determine atmospheric transmission at visible and infrared wavelengths over battlefields and other tactical areas, and techniques to apply satellite-obtained cloud imagery, will be developed for use in supporting electro-optical weapons systems. The new long-wave length infrared data obtained on zodiacal, celestial, and Earth limb backgrounds will be used to update background radiation specifications for designing surveillance systems. A medium wavelength infrared spatial mapper will be developed to obtain improved backgrounds and signature data in this potentially important wave length region for surveillance. Development of a capability to determine the size and state of precipitating particles using a Doppler weather radar will begin. This capability is required during the test and evaluation of several generic Air Force systems. A visibility sensor suitable for base-base tactical airfield deployment will be developed. Other efforts in FY 1982 will include: Sensors will be developed for flight on Shuttle to characterize the electrical sheath and wake generated as the Shuttle moves through the space plasma; these data are needed for evaluation of Department of Defense experiments on Shuttle. A balloon-borne ion mass spectrometer will obtain data on stratospheric ions input into Very Low Frequency/Low Frequency radio propagation models used for predicting communications that will be survivable during a nuclear engagement. An accelerometer will be flown on the Space Transportation System Orbital Flight Test 4 to calibrate the Shuttle acceleration environment and also to obtain atmospheric density values at Shuttle orbital altitudes. A sensor to measure the Earth limb ultraviolet emission profile will be developed to obtain the information required to determine if satellite horizon sensors operating in the ultraviolet can meet mid-1980s satellite horizon sensing requirements. A production model laser gyroscope will be adapted for low-cost and easy measurements of azimuth and astronomic altitudes at Intercontinental Ballistic Missile sites. Earth motion data will be obtained during National Aeronautics and Space Administration Space Shuttle launches, to verify predicted Earth motions that would be experienced by Air Force Shuttle launch support facilities at Vandenberg Air Force Base. Earth motion measurements will be made at candidate sites for the Triservice Base Installation Security System and the sources of these motions determined to develop techniques to reduce system false alarm rates. Models will be developed to predict weather element probabilities in areas where no data exist using knowledge of the local topography, and water and vegetation distributions; these models are required for war gaming and military operation planning.

Program Element # 62101F

DOD Mission Area: Environmental and Life Sciences #522

Title: Geophysics

Budget Activity: Technology Base #1

4. (U) FY 1983 Planned Program: Efforts associated with the Program Element's major thrusts will include the following. Space chamber studies will be conducted of potential interactions between the space environment and large spacecraft which would act to seriously limit system capabilities. Models will be developed to define the atmospheric optical emissions that could result from use of charged particle beams; such emissions could be give-aways of hostile particle beam use. Data taken in Germany on the low-level structure of hazes and fogs will be used to construct an improved see-ability model needed for improving precision-guided munitions intended for use against the Warsaw Pact forces. At the request of the United States Air Force's Air Weather Service, a remote imaging sensor operating at ultraviolet wavelength will be developed and flown on a Defense Meteorological Satellite to improve the monitoring and prediction of ionospheric changes adversely affecting special classified strategic systems. A specially modified Global Positioning System receiver and techniques will be developed to use Global Positioning System signals to determine the total electron content of the overhead ionosphere; this quantity is operationally required for correctly locating and tracking enemy satellites using ground-based radars. An improved model of the variation of gravity over the globe will be developed to meet MX and long-range cruise missile accuracy requirements. The advantages of using high spectral resolution satellite radiance measurements to determine atmospheric moisture content will be studied to assist the Defense Meteorological Satellite program office in determining future satellite instrumentation requirements. Improvements to tactical weather forecasting from melding radar-sensed surrounding cloud structure with corresponding information obtained from an overhead satellite will be investigated. Other efforts in FY 1983 will include: A new program to investigate the feasibility of obtaining terrain profiles from a satellite-borne altimeter for cruise missile application. The response of the magnetosphere to a man-made disturbance will be studied to improve understanding of the space processes responsible for outages of military communication at high latitudes. A rocket-borne nuclear environment simulation experiment will be conducted in space to obtain data needed to improve computer models used for evaluating the performance of Department of Defense Air Force systems during nuclear engagements. A vastly improved model will be developed for predicting the location of enemy satellites needed for anti-satellite warfare. Studies of ionospheric modification using ground-based, high intensity radio frequency emissions and controlled rocket burns will be conducted to determine if such modifications could be used by an enemy to adversely affect Department of Defense systems, or conversely by the United States to disrupt enemy systems. New hardware for the Automated Azimuth Measuring System will be designed to reach the upgraded accuracy levels needed for in-place alignment of operational missile guidance systems and laboratory testing of Department of Defense inertial guidance components.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: # 06DK

Program Element: # 62101F

DOD Mission Area: Environmental and Life Sciences

Title: Air Force Geophysics Laboratory Operation

Title: Geophysics

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for operation of the Air Force Geophysics Laboratory, Hanscom AFB MA, including pay and related costs of civilian scientists and support personnel, travel, transportation, rents, communications, and utilities costs, procurement of supplies and equipment, and contractor support services. The Air Force Geophysics Laboratory performs research and exploratory development in the geophysical sciences, i.e., geodesy, geokinetics, meteorology, optical physics, ionospheric physics, upper atmosphere physics, and space physics in support of the immediate or potential needs of Air Force operational systems.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element.

(U) WORK PERFORMED BY: The program is managed by the Air Force Geophysics Laboratory, Hanscom AFB MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Plans and accomplishments are discussed in the overall program element which is included in this submission.

1. (U) FY 1980 and Prior Accomplishments: Not applicable

2. (U) FY 1981 Program: Not applicable

3. (U) FY 1982 Planned Program: Not applicable

4. (U) FY 1983 Planned Program: Not applicable

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	17,247	16,458	17,921	18,310	Continuing	Not applicable

8. (U) Comparison with FY 1981 Budget Data:

16,600 18,100 18,400

The FY 1982 budget data reflects the transfer of computational services cost from this support project to each of the using projects. The 1 October 1980 civilian pay raise (9.1%) has been included in the FY 1982 budget data.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Materials

Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	34,863	37,600*	44,000	53,800	Continuing	Not applicable
06DS	Laboratory Operations	14,225	12,702*	13,976	14,276		
2417	Thermal Protection Materials	2,275	2,998	3,744	4,774		
2418	Metallic Structural Materials	4,610	5,100	5,800	7,900		
2419	Nonmetallic Structural Materials	4,300	4,700	5,500	7,420		
2420	Aerospace Propulsion Materials	2,275	3,100	3,820	4,810		
2421	Fluid, Lubricants and Fluid Containment Materials	2,200	2,950	3,670	4,430		
2422	Protective Coatings and Materials	2,425	2,970	3,690	4,670		
2423	Electromagnetic Windows and Electronic Materials	2,553	3,080	3,800	5,520		

*Excludes Oct 80 civilian pay raise.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the entire Air Force exploratory development program in materials. It develops new and improved materials which are required to meet the increased performance, reliability and survivability of current and future aerospace systems. The program also provides management and operational support for the Materials Laboratory, Wright-Patterson Air Force Base, OH, as the central Air Force agency concerned with all aspects of materials research, development and manufacturing technology.

(U) BASIS FOR FY 1982 REQUEST: The needs of Air Force aircraft and spacecraft are specialized and unique and cannot be satisfied by research and development directed at civilian needs. The FY 1982 funds will be used to support programs which address current and projected deficiencies in materials technology which impact the Air Force mission. These projects will highlight carbon/carbon composites for gas turbine engine applications; rapid solidification rate powder metallurgy technology; the development of materials and processing techniques designed to reduce our dependence on critical/strategic metals and natural petroleum products; and the protection of Air Force systems from the effects of high energy laser radiation. Emphasis will continue to be on a balance of materials performance, reliability and durability properties. The cost estimates were derived using analogous contract experience adjusted for program complexity and inflation.

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Materials
Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RDT&E (3600)	34,200	39,100	43,500		Continuing	Not applicable
<u>(U) OTHER APPROPRIATION FUNDS:</u>						
Military Construction				14,300	18,400	32,700

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Materials

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop new and improved aerospace materials; provide reliable materials property design data for new materials; better utilize existing materials; and to maintain the Materials Laboratory as the center of Air Force expertise on operational materials problems, materials processing and materials failure analysis. The areas of materials development applicable to aerospace systems are structural, propulsion, electromagnetic, elastomeric, and thermal protection materials as well as lubricants, hydraulic fluids and protective coatings. The technology developed through this program will satisfy the requirement for aerospace materials resistant to hostile environments of high temperature, mechanical erosion, chemical corrosion, laser radiation and nuclear effects; electromagnetic materials used in infrared detectors, lasers and semiconductor devices; lighter weight structural materials of high reliability with resistance to sudden failure; materials to meet long life lubricant requirements for space systems and aircraft; and more thermally and chemically stable seals, sealants, and hydraulic fluids. This program element is not only the primary technology base materials exploratory development effort in the Air Force, but also it provides technical support to other Air Force and Department of Defense agencies and is partially reimbursed by those agencies for the services rendered. The Materials Laboratory is fully reimbursed for basic research efforts by PE 61102F, Defense Research Sciences. The project break reflects the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: All three military services, Defense Advanced Research Projects Agency, the National Aeronautics and Space Administration, the Department of Energy, and industry, through the Independent Research and Development program, carry out research and development programs in materials technology specifically related to their requirements. Coordination is provided by the exchange of planning documents and joint agency technical committees and symposia such as the Department of Defense Metal-Matrix Composite Steering Committee, the Materials Development Coordination Committee for Advanced Strategic Reentry Vehicles, the Department of Defense Materials and Structures Technology Conference, and the Tri-Service Laser Hardened Materials and Structures Group. These joint planning meetings and materials coordination activities highlight the specialized materials requirements of each organization and are determining factors in the formulation of complementary, nonredundant materials research and development programs. Interface with industry and the civilian community is reinforced by active participation in academic and professional organizations and societies. This program element receives specific input from PE 61102F, Defense Research Sciences, and provides technical output to other program elements such as PE 63211F, Aerospace Structures and Materials, PE 78011F, Manufacturing Technology, and PE 63313F, Advanced Ballistic Re-entry Systems.

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Materials

Budget Activity: Technology Base, #1

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for the management of this program. Ten major contractors in FY 1980 were: Avco Corporation, Greenwich, CT; General Electric, Schenectady, NY; General Dynamics, St. Louis, MO; Honeywell, Minneapolis, MN; Hughes, Culver City, CA; McDonnell-Douglas Corporation, St. Louis, MO; Rockwell International, El Segundo, CA; Systems Research Laboratories, Beavercreek, OH; United Technologies, Sunnyvale, CA; and University of Dayton Research Institute, Dayton, OH. In addition to the above, there are 56 other industrial contractors, 27 non-profit contractors and a total of 274 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Programs for subscale development of laser hardening concepts for satellite subsystems to meet near term hardening concepts were transitioned into full scale development programs. Fine weave carbon/carbon materials were developed for use in shape stable reentry vehicle nosetips. Performance and reliability of gas turbine engines were significantly advanced by improved materials for discs, turbine blades and vanes, fans and compressors, bearings and gas path seals. Superplastic forming/diffusion bonding techniques which greatly simplified the working of titanium were refined and transitioned into advanced development. Erosion resistant coatings for infrared and laser window materials were developed and made available for systems use. Nonflammable hydraulic fluids, high adhesion fuel tank sealants, and the degradation limits of lubricants in spacecraft use were developed to increase aircraft safety and spacecraft reliability. New coatings for visual and infrared camouflage were successfully formulated and made available for current and future aerospace systems.

2. (U) FY 1981 Program: The FY 1981 program will build on the accomplishments of the FY 1980 program and will continue the Department of Defense and Congressionally directed emphasis of carbon/carbon and metal-matrix composite technologies. Highlighted areas will also include aluminum alloys with greatly improved mechanical properties, powder titanium processing, silicon and mercury cadmium telluride infrared detector materials for both space and tactical imaging systems, materials for long life space traveling wave tubes and high voltage power supplies, and improved thermal protection materials for heat shields on advanced ballistic missile reentry vehicles. Nondestructive evaluation techniques will continue to emphasize greater automation and reliability. Programs will be initiated which decrease our dependence on scarce metals and natural petroleum crudes by the development of new alloys and synthetic hydrocarbon product technology. Efforts to improve the performance and reliability, while reducing cost, of electronic and electromagnetic materials will continue.

Program Element: #62102F

Title: Materials

DOD Mission Area: Engineering Technology (ED), #523

Budget Activity: Technology Base, #1

3. (U) FY 1982 Planned Program: The FY 1982 planned program will continue the support of erosion resistant carbon/carbon and metal-matrix composite technologies. Increased emphasis will be placed on rapid solidification rate powder metal technology. The applicability of ceramics and carbon/carbon composites to gas turbine engines will be determined and the development of necessary oxidation resistant coatings for carbon/carbon will be begun. Emphasis will be placed on programs which reduce the dependence on critical/strategic metals and natural petroleum products both by new materials development and improved manufacturing processes. Laser hardened materials technology programs will be continued with increased emphasis on pulsed laser effects. Also highlighted will be synthetic hydrocarbon chemistry; contamination control in space; improved antenna window materials for strategic reentry vehicles; high temperature resistant adhesives and sealants; improved vibration damping techniques; aircraft paints, coatings, and stripping techniques compatible with environmental restrictions, as well as a broadly based program in nondestructive inspection technology designed to increase detection capability while decreasing the requirement for human judgements.
4. (U) FY 1983 Planned Program: Developments discussed in the FY 1982 planned program will continue, with changes in emphasis dependent upon the results obtained in FY 1981 and FY 1982. Potential areas of emphasis are new strategic reentry vehicle nosetip construction techniques, improved metal removal techniques, self-reinforcing composites, validated engine materials life prediction models, fuel tank sealants, camouflage coatings, and new types of strategic reentry vehicle antenna window materials.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #06DS

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Materials Laboratory Operations

Title: Materials

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Materials Laboratory and includes the pay and related costs of civilian scientists, engineers and supporting personnel, travel, transportation, rents, communications, and utilities cost, procurement of supplies and equipment, and contractor support services. The Materials Laboratory is responsible for the Air Force exploratory and advanced development programs in the area of materials technology, a portion of the basic research program in materials, and for the Air Force Manufacturing Technology program. The laboratory provides technical support to current and future system program offices, the Air Force Logistics Command, and the operational commands. It also maintains a quick reaction capability to respond to operational problems involving technology, materials application, and failure analysis. The laboratory provides technical support to current and future systems programs and maintains a quick reaction capability to respond to operational problems involving technology, materials application, and failure analysis.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element as well as all other projects and programs managed by the Materials Laboratory.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for management of the projects included under the Materials program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.

2. (U) FY 1981 Program: Not applicable.

3. (U) FY 1982 Planned Program: Not applicable.

4. (U) FY 1983 Planned Program: Not applicable.

5. (U) Program to Completion: Not applicable.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDTE (3600)	14,225	12,702*	13,976	14,276	Continuing		

* Does not include Oct 1980 Pay Raise (9.1%)

Project: #06DS

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Materials Laboratory Operations

Title: Materials

Budget Activity: Technology Base, #1

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E (3600)	13,300	14,200	14,400	-	Continuing	Not applicable

The FY 1982 increase results from revised estimates of reimbursement for support provided to other programs and agencies.

Project: #2418

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Metallic Structural Materials

Title: Materials

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop and apply metallic structural materials and process technology to reduce acquisition and maintenance costs, improve structural life and reliability and improve performance of Air Force aerospace structural systems. This encompasses the development of metallic materials and processes to give alloys having high toughness/density ratios, better processing and joining techniques, higher use temperatures, and more predictable properties. Nondestructive measurement, evaluation, and inspection techniques are developed to allow greater quality assurance and service life inspection. Systems support in the forms of failure analysis, repair techniques, and inspection is provided to the operational and logistic commands.

(U) RELATED ACTIVITIES: In the area of metallic materials, all Department of Defense services, the Defense Advanced Research Projects Agency, The National Aeronautics and Space Administration and many industrial and academic organizations conduct programs related to the Air Force effort. Coordination is provided by joint agency technical committees, exchange of planning documents, technical symposia and the Department of Defense Materials and Structures Technology Conference. These activities assure that the unique and specialized materials requirements of each service are being met and where development goals are similar, the efforts are complementary.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for the management of this program. The ten major contractors for FY 1980 were: Rockwell International, El Segundo, CA; Systems Research Laboratories, Dayton, OH; University of Dayton Research Institute, Dayton, OH; University of Cincinnati, Cincinnati, OH; Universal Technology Corporation, Dayton, OH; Westinghouse Corporation, Pittsburgh, PA; Battelle Memorial Institute, Columbus, OH; Miami University, Oxford, OH; United Technology, Sunnyvale, CA; and Avco Corporation, Greenwich, CT. In addition to the above, there are 7 other industrial contractors, 5 non-profit contractors and a total of 35 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Maintenance costs were reduced by the development and application of improved welding and brazing techniques. Superplastic forming and diffusion bonding techniques have greatly simplified the working of titanium and were transitioned into advanced development. Basic technology for metal matrix composites was developed jointly with the Defense Advanced Research Projects Agency. Additional accomplishments include advanced powder aluminum metallurgy, aluminum casting techniques, corrosion inhibitors and techniques to predict adhesively bonded joint life.

Project: 2418

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Metallic Structural Materials

Title: Materials

Budget Activity: Technology Base.#1

2. (U) FY 1981 Program: The major thrusts will continue to be the improvement of structural integrity and reliability through the control and optimization of material properties and behavior, the development and exploitation of materials processes such as selective reinforcement, hydrovac processing, diffusion bonding and superplastic forming to achieve cost affordable titanium structures; development of new metallurgical approaches to longer fatigue life and higher temperature capability in structural aluminum alloys via powder metallurgy technology, along with the necessary processing and joining technology; the development and demonstration of usable, reliable, ultrasonic technology for maintenance of complex structures; the development of improved eddy current technology for reliable detection of small surface flaws; and the extension of fracture prediction capability to nonlinear and multiple crack situations.

3. (U) FY 1982 Planned Program: The FY 1982 program will build on the accomplishments of the FY 1981 program and will continue to emphasize metal-matrix and powder metallurgy technologies. Improved system performance and life expectancy will be sought by developing new powder metal alloys of aluminum, titanium and nickel based superalloys by rapid solidification rate powder forming techniques. Additional emphasis will be given to reducing the need for high cost, short supply metals such as cobalt and chromium by developing new alloys and improved metal working techniques. Thrusts in nondestructive evaluation technologies will include: improved ultrasonic and eddy current inspection methods, new liquid penetrant inspection processes for use by field inspection facilities, improved ultrasonic signal processing techniques which will increase the reliability of inspection of complex shapes and multilayer structures, and the development of inspection techniques for carbon/carbon composite structures.

4. (U) FY 1983 Planned Program: Developments discussed in the FY 1982 planned program will continue with changes in emphasis dependent upon results obtained during FY 1981 and FY 1982. Potential areas of emphasis are titanium powder metallurgy with a goal of demonstrating 40-60% cost reduction for thick section titanium airframe applications and improved methods of metal removal which would reduce machining costs and material loss.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RD&E (3600)	4,610	5,100	5,800	7,900	Continuing		
8. (U) <u>Comparison with FY 1981 Budget Data:</u>							
RD&E (3600)	4,600	4,900	5,800	-	Continuing		Not Applicable

Project: #2419

Program Element: #62102F

DOD Mission Area: Engineering Technology (ED), #523

Title: Nonmetallic Structural Materials

Title: Materials

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops nonmetallic materials and the supporting technology necessary to apply these new materials to aerospace structures. It was responsible for the development of the graphite and boron fiber reinforced organic matrix composites and continues to develop new and improved organic resin matrix composites having higher use temperatures, higher strength, greater resistance to environmental effects and higher strength/density and stiffness/density. Also included are advanced, lower cost fabrication methods as well as new adhesives and structural property determinations.

(U) RELATED ACTIVITIES: In the area of nonmetallic materials, all Department of Defense services, the Defense Advanced Research Projects Agency, The National Aeronautics and Space Administration, and many industrial and academic organizations conduct programs related to the Air Force effort. Coordination is provided by joint agency technical committees, exchange of planning documents, technical symposia, and the Department of Defense Materials and Structures Conference. These activities assure that the unique and specialized materials requirements of each service are being met and where development goals are similar, the research efforts are complementary.

(U) WORK PERFORMED BY: The Materials Laboratory, Wright-Patterson Air Force Base, Oh, is the organization responsible for the management of this program. Ten major contractors in FY 1980 were: Avco Corporation, Greenwich, CT; University of Dayton Research Institute, Dayton, OH; TRW Incorporated, Redondo Beach, CA; Rockwell International, Los Angeles, CA; General Dynamics, St. Louis, MO; Honeywell, Minneapolis, MN; Hughes, Culver City, CA; General Electric, Schenectady, NY; Celanese Corporation, Summit, NJ; and Lockheed Missiles and Space, Sunnyvale, CA. In addition to the above, there are 10 other industrial contractors, 12 non-profit contractors and a total of 42 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The current graphite and boron fiber reinforced organic matrix composites were developed and transitioned into advanced development and systems application. Adhesives and adhesive bonding technology allowed lower cost, more reliable metal aircraft structures. An Air Force Center of Excellence in polymer technology was established and continues to develop the basic knowledge necessary for plastics, fibers, lubricants, paints and adhesives. Methods to mathematically understand the complex nature of composite materials were developed and applied to aerospace structures with a resulting improvement in design, service life, and economy of manufactures.
2. (U) FY 1981 Program: Emphasis is placed on predicting the behavior of composite structures under operational conditions; including the development of more environmentally resistant matrix resins, better repaid and inspection techniques, and methods to correlate the quality of matrix resins with the fabricated composites' mechanical properties. Programs in adhesive development are designed to develop adhesives, primers, surface treatments, and cure processes which are more cost efficient in the production plant and more applicable to the airbase shop.

Project: #2419

Program Element: #62102F

Title: Nonmetallic Structural Materials

Title: Materials

DOD Mission Area: Engineering Technology (ED), #523

Budget Activity: Technology Base #1

3. (U) FY 1982 Planned Program: The FY 1982 planned program will emphasize the correlation of starting material composition and processing technology with the properties of the final composites. Methods of quality control will be developed for starting resins and the effects of different combinations of materials and processing conditions will be determined. The development of higher use temperature, more easily processed polymers will be continued. Programs will be initiated to determine the relationships of load, environment, and material properties to the mechanics of damage initiation, damage growth, and failure of composites. Adhesives designed for use in high temperature aeropropulsion applications will be developed.

4. (U) FY 1983 Planned Program: Developments discussed in the FY 1982 planned program will continue with changes in emphasis dependent upon results obtained during FY 1981 and FY 1982. Potential areas of emphasis are high strength, ordered polymers capable of producing self reinforcing composites, low cure-temperature adhesives and detailed quality control production specifications.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980</u> <u>Actual</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RD&E (3600)	4,300	4,700	5,500	7,420	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1980 Budget Data:</u>						
RD&E (3600)	4,300	4,600	5,500	-	Continuing	Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62201F Title: Aerospace Flight Dynamics
 DOD Mission Area: Engineering Technology (ED), #523 Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	50,190	52,300*	56,100	73,000	Continuing	Not applicable
06DF	Laboratory Operations	26,598	27,600*	29,900	30,600		
2401	Structures and Dynamics	5,976	5,900	6,200	13,300		
2402	Vehicle Equipment	4,563	4,700	4,900	9,000		
2403	Flight Control	5,350	6,200	6,600	10,900		
2404	Aeromechanics	7,703	7,900	8,500	9,200		

*Does not include Oct 1980 Pay Raise (9.1%)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This exploratory development program provides the flight vehicle technologies required for the design and development of future aerospace vehicles (aircraft, missiles, and spacecraft) and for the improvement of current vehicles. It encompasses the technical areas of structures, aerodynamics, aerothermodynamics, flight performance analysis, vehicle dynamics, flight control, crew station design, crew escape and recovery, environmental control, mechanical subsystems, survivability/vulnerability, and technology integration. The program also provides for the operational support and management of the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH.

(U) BASIS FOR FY 1982 RDT&E REQUEST: These funds will be used to develop flight vehicle technologies which will enhance the capabilities of future aerospace vehicles and improve the capabilities of existing vehicles. New design techniques and criteria are to be developed for structures built of composite materials which consider fatigue and fracture toughness, as well as the usual stress loading, deflection and geometry. Test procedures will be developed for the reliability evaluation of avionics equipment through the use of accelerated environmental testing which will produce results in agreement with actual field experience. Technologies will be explored which offer solutions to the problem of sustaining combat operations off of damaged runways and alternate surfaces. Integrated control concepts will be developed which support alternate penetration tactics which will enhance the survivability of fighter/attack and bomber aircraft. Aerodynamic prediction techniques will be developed and expanded to address new flight vehicle problems such as higher speeds, reentry vehicles, weapons bay and release problems, and new configurations designed for low observability. Cost estimates were derived using analogous contract experience adjusted for program complexity and inflation.

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Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Flight Dynamics
Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
TOTAL FOR PROGRAM ELEMENT	49,000	56,800	62,500		Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
Military Construction	9,700*	*		3,600		

*Authorized in FY 1980, appropriated in FY 1981.

Program Element: #62201F

Title: Aerospace Flight Dynamics

DOD Mission Area: Engineering Technology (ED), #523

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element supports work in many scientific disciplines and technical domains. The Structures and Dynamics area includes the use of metallic, nonmetallic, and composite materials, processes, and techniques for fastening, joining, and bonding; load analysis and testing; fracture and fatigue investigations; aeroelasticity, flutter, vibration, and acoustics. Vehicle Equipment includes landing gear components; pivots and bearings; environmental control systems; survivability/vulnerability; and crew accommodation, protection and escape. The Flight Control area involves flight control systems, control augmentation, all-weather operation, cockpit configuration and displays, and flight and ground simulation. Aeromechanics deals with aerodynamics, agility, aerodynamic heating, aircraft and propulsion system integration, wind tunnel testing, and configuration research. The ultimate objective of all efforts in these areas is to provide the advanced flight vehicle technology which forms the base for developing effective, efficient, and economical weapon systems to perform the Air Force mission. This program element, in addition to being the primary technical base exploratory development effort in flight vehicle technology, provides technical support to other Air Force and DOD agencies and receives partial reimbursement for the services provided.

(U) RELATED ACTIVITIES: This program receives technology inputs from In-House Laboratory Independent Research (PE 61101F), Defense Research Sciences (PE 61102F) and from Materials (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the technology product of this program is applied to Flight Vehicle Technology (PE 63205F), Aerospace Structures & Materials (PE 63211F), Aircraft Nonnuclear Survivability (PE 63244F), Advanced Fighter Technology Integration (PE 63245F), and other advanced development, engineering development, and system development programs. Joint and cooperative projects are conducted with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Area Descriptions and Technical Reports.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. The laboratory makes use of in-house facilities and other Air Force, Government and industry facilities. The ten major contractors are: Rockwell International, Los Angeles, CA; The Boeing Company, Seattle, WA; General Dynamics, Fort Worth, TX; Systems Control, Inc., Palo Alto, CA; McDonnell Douglas, St. Louis, MO; McDonnell Douglas Astronautics-East, St. Louis, MO; Calspan, Buffalo, NY; Grumman Aerospace, Bethpage, NY; Bunker-Ramo Corporation, Westlake Village, CA; Lear Siegler, Inc., Oklahoma City, OK. Currently there are 64 total contractors and 196 total contracts; six are overseas contractors.

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Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Significant recent accomplishments include: (1) development and evaluation of an advanced cryogenic cooler for forward looking infrared (FLIR) sensor systems which would significantly reduce the operational and support costs, (2) flight test of a closed loop digital flight control system using a multiplex data bus, this capability provides the building block for future systems with increasingly complex capabilities, (3) detailed analysis and evaluation of F-4 aircraft operating on damage repaired runways led to interim guidance for operation of the fleet and potential modifications to improve fleet capabilities, (4) an advanced head up display was developed for the KC-135 boom operator which offers both improved safety and operational effectiveness in aerial refueling operations.

2. (U) FY 1981 Program: Explore the characteristics of composite material structures, including strength, durability, fatigue tolerance, and environmental resistivity. Extend the combined environments reliability test (CERT) concept, which has proven successful for internally carried avionics, to externally carried avionic stores. Initiate investigations into precision time/trajectory control concepts. Studies will include crew/control interface and display of essential data as well as required vehicle control techniques. Initiate a technology assessment to determine which technologies could significantly impact large aircraft performance.

3. (U) FY 1982 Planned Program: Develop, apply and evaluate new unsteady aerodynamic prediction methods and obtain corresponding experimental data in the difficult transonic flow regime. Better prediction not only improves understanding of these phenomena but also allows for improved flight vehicle design. New efforts will be initiated to develop accelerated environmental test techniques which will provide good correlation with field reliability experience. Better correlation leads to correction of design problems early in the equipment life cycle and improved repair and spare parts logistics. Continue the development and maintenance of the Air Force Stability and Control Data Compendium, better known as DATCOM, its computer implementation, and Digital DATCOM. DATCOM is the free world standard for estimating stability and control characteristics of aircraft conceptual designs. DATCOM will be extended to missile configurations. Tests will be conducted to gather data which will verify and validate aerodynamic heating prediction techniques. Currently, only simple shapes such as cones and cylinders can be predicted with confidence.

4. (U) FY 1983 Planned Program: Aerodynamic prediction techniques will be developed for ever expanding flight conditions such as high angle of attack, transonic maneuvering, and low speed flight. Preliminary design criteria for high visibility birdstrike resistant windshield materials for sustained flight at Mach 2.5 will be developed. Newly emerging digital architecture will be applied to flight control systems to improve reliability, supportability, and vehicle survivability. Continue the assessment of flight vehicle concepts for effectiveness of high technology aircraft with ballistic weapons versus lower technology aircraft with glide and cruise weapons.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06DF

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Dynamics Laboratory Operations

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. The mission of the laboratory is to plan and execute the USAF exploratory development, advanced development and selected research and engineering development programs in aerospace flight vehicles. The laboratory also provides technical support within its mission areas to other Air Force organizations, the Army, the Navy, other Department of Defense agencies, National Aeronautics and Space Administration, and other government agencies. This project covers pay and benefits of civilian scientists and engineers and supporting personnel, travel, transportation, rents, communications, and utilities costs, procurement of supplies and equipment, and contractor support services.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element, as well as all other projects and activities managed or conducted by Flight Dynamics Laboratory. Other programs supported include Program Element (PE) 63205F, Flight Vehicle Technology; PE 63211F, Aerospace Structures and Materials; PE 63244F, Aircraft Nonnuclear Survivability; PE 63245F, Advanced Fighter Technology Integration; PE 64212F, Aircraft Equipment Development; and PE 63428F, Space Surveillance Technology.

(U) WORK PERFORMED BY: The Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH is responsible for management of this project and other projects included under the Aerospace Flight Dynamics program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.
2. (U) FY 1981 Program: Not applicable.
3. (U) FY 1982 Planned Program: Not applicable.
4. (U) FY 1983 Planned Program: Not applicable.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #06DF

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Dynamics Laboratory Operations

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	26,598	27,600*	29,900	30,600	Continuing	Not Applicable

* Does not include Oct 1980 Pay Raise (9.1%)

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	25,500	27,100	27,500	-	Continuing	Not Applicable

FY 1982 funding has been increased due to the 1 October 1980 civilian pay raise and increased per diem allowances.

Project: #2401

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Structures and Dynamics

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The purpose of this project is to develop and demonstrate structural mechanics and vehicle dynamics technology which will result in lower cost, lower weight, improved performance, and assured design life for advanced flight vehicles. The project includes three major goals: (1) Effective application of advanced materials to aircraft, missiles and space vehicles. (2) Generating new basic structural and dynamic criteria, techniques and concepts that will facilitate the design and development of weapon systems. (3) Maintaining the technical capability and unique facilities to attain the preceding goals and providing the expertise and audit capability required for structures and dynamics technical support to other organizations.

(U) RELATED ACTIVITIES: This project receives inputs from Defense Research Sciences (PE 61102F), from Materials (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the output of this project is applied to Flight Vehicle Technology (PE 63205F), Aerospace Structures and Materials (PE 63211F), other advanced development, engineering development, and system development programs. Joint and cooperative efforts are conducted with other Air Force Systems Command Laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Coordinating Papers.

(U) WORK PERFORMED BY: Work under this project is performed in-house by the Flight Dynamics Laboratory, Wright Aeronautical Laboratories, and under contracts managed by that laboratory. Use is made of in-house facilities, such as the Structures Test Facility and the facilities of other Air Force organizations, other government organizations, industry, and foreign countries. The ten major contractors are: Rockwell International, Los Angeles, CA; General Dynamics, Fort Worth, TX; Grumman Aerospace, Bethpage, NY; Lockheed Aircraft, Burbank, CA; University of Dayton, Dayton, OH; McDonnell Douglas, St. Louis, MO; Northrop Corporation, Hawthorne, CA; The Boeing Company, Seattle, WA; Anamet Laboratories, Berkeley, CA; National Aerospace Laboratory, Amsterdam, Netherlands. Currently there are 19 total contractors and 55 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Significant recent accomplishments include: (1) issue of the Damage Tolerance Handbook, (2) demonstration of a successful, inexpensive detection technique for Cruise Missiles by measuring acoustic signatures, (3) demonstrated in wind tunnel tests several active control concepts that could raise flutter speed placards by at least 30 percent for fighter configurations with flutter-critical external stores, and (4) provided guidance to Tactical Air Forces for the interim operation of F-4 aircraft on damaged and repaired runways.

Project: #2401

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Structures and Dynamics

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Exploratory development work will be applied to broaden the data base for composite structures; in particular, characterization of the strength, durability, fatigue tolerance, and environmental restivity will be explored. Load prediction technologies will be developed for structures in dynamic deflection, for complex structures such as wing-body configurations, and for new missile configurations. Correlation of experimental data with analytic predictions will provide confidence in and verification of analytic techniques; correlations are obtained through wind tunnel tests, ground tests, and flight tests. Additional work will be done in active flutter suppression.

3. (U) FY 1982 Planned Program: Develop, apply and evaluate new unsteady aerodynamic prediction methods and obtain corresponding experimental data in the difficult transonic flow regime. Accurate prediction techniques reduce the difficulty, time, and cost of developing new weapons systems. Structural design techniques for composite material structures which consider fatigue and fracture requirements, stress, deflection, geometry, and aerodynamic heating will be developed. This capability is required nationally to design composite structures and by the Air Force in particular in order to be able to assess contractor predictions and proposals. The dynamic structural response of aerospace vehicles to external excitation causes such phenomena as flutter, sonic fatigue, and ground taxi loads. Each of these will be explored to better understand the phenomena as they affect future aircraft designs.

4. (U) FY 1983 Planned Program: Prediction and design techniques will be developed for ever expanding flight conditions such as high angle of attack, transonic maneuvering, and low speed flight. Vehicle operation in these areas provide improved combat effectiveness. The verification of composite material structure design tools will be accomplished through ground test and service life tracking. High cost maintenance items identified in the current fleet will be assessed for new technology replacement components. The potential for savings in Air Force operating and maintenance funds is significant.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands):

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	5,976	5,900	6,200	13,300	Continuing	Not applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u> (\$ in thousands)						
RDT&E Funds	6,000	7,300	8,500	Continuing	Continuing	Not applicable

Project: #2403

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Control

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The purpose of this project is to develop flight control systems technology which matches the performance and dynamic characteristics of the vehicle, its armament and mission systems with the pilot to obtain maximum capability while assuring safety, survivability and economy. The elements of flight control technology include cockpit arrangements, control logic, aircraft stability and control, control sensors, and actuation subsystems. Included are laboratory, wind tunnel, simulation and/or flight tests necessary to demonstrate the validity of advanced control concepts, devices and techniques. Transition is enhanced by involvement of the using commands wherever possible in the evaluation and validation process. The principal formal means of technology transition is through specifications, handbooks, design guides and criteria, and technical reports.

(U) RELATED ACTIVITIES: This project received inputs from Defense Research Sciences (PE 61102F) and from Avionics (PE 62204F), as well as from the products of other national and international research and development activities. In turn, the output of this program is applied to Flight Vehicle Technology (PE 63205F), Advanced Fighter Technology Integration (PE 63245F), Digital Avionics Information System (DAIS) (PE 63243F), other advanced development, engineering development, and system development programs. Joint and cooperative projects are conducted with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, Federal Aviation Agency, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technology Coordinating Papers.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. Use is made of in-house facilities and the facilities of other Air Force organizations, other Government organizations and industry. The ten major contractors are: Systems Control Inc., Palo Alto, CA; Bunker-Ramo Corporation, Westlake Village, CA; Calspan Corporation, Buffalo, NY; Lear Siegler Inc., Oklahoma City, OK; Electronic Associates, Inc., Long Branch, NJ; Honeywell, Inc., Minneapolis, MN; Dynamic Controls Inc., Dayton, OH; McDonnell Douglas Astronautics-East, St. Louis, MO; Systems Technologies Inc., Hawthorne, CA; Singer Co., Binghamton, NY. Currently there are 29 total contractors and 47 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Recent significant accomplishments include: (1) flight control simulations were performed in-house in support of the Advanced Fighter Technology Integration (AFTI) and Integrated Flight Fire Control (IFFC) advanced development programs, aircraft accident investigations, and tanker refueling systems acquisition, (2) flight tests were accomplished on digital flight control system components including the first flight of a digital multiplex data bus closed loop flight control system; both twisted shielded pair and fiber optic transmission lines were tested in simulated lightning environments demonstrating these systems can be designed to minimize their susceptibility to atmospheric electrical hazards, (3) a flat panel multi-mode matrix display was demonstrated; this technology may eventually replace bulky cathode ray tube displays, (4) a high frequency hydraulic actuator for use in a flutter control system completed wind tunnel test demonstrating the capabilities of a new simulation tool which will aid in future investigations of active flutter control technology.

Project: #2403

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Control

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Flight tests will be accomplished to evaluate weapon delivery in a maneuver against a single target. Maneuvering delivery enhances vehicle survivability, automatic flight control provides the capability to maintain weapon accuracy. Simulations will be performed to assess the potential of thrust modulation and/or reversal during combat maneuvers. Initial indications are that thrust modulation may provide an added dimension to air-to-air combat. Investigation of display and control requirements for precision time/trajectory control will be initiated. Such control in bomber, tanker, transport vehicles can enhance survivability in wartime as well as improve overall efficiency during peacetime operations. Development will be initiated for an "inside-out" electric actuator which will have both a low profile and high operating temperature characteristics required for missile applications. Analysis of self-repairing software configurations will be initiated for application to flight critical fly-by-wire applications.
3. (U) FY 1982 Planned Program: Simulations will be initiated to develop integrated control concepts which support altitude penetration tactics such as high speed dash, terrain following, terrain masking, evasive maneuvering and lethal countermeasures. The payoff is survivability for both fighter/attack and bomber aircraft. Mission systems management techniques will be explored; these are the cockpit hardware and supporting technologies required to provide the flight crew with essential mission data, systems status required for effective operations. Continue the development and maintenance of DATCOM and Digital DATCOM. DATCOM is the free world standard for estimating stability and control characteristics of aircraft conceptual designs. Work will be done to extend DATCOM to missile configurations. An assessment will be made of the requirements to study cockpit lighting problems; results will be recommendations for alternate approaches to evaluating cockpit lighting problems.
4. (U) FY 1983 Planned Program: Flight tests will be accomplished to evaluate weapon delivery in maneuvering flight against multiple ground targets; this includes attacking multiple targets per pass and penetrating multiple defenses. Studies will be initiated to develop criteria for space transportation system crew stations. Newly emerging digital architecture will be applied to flight control systems to improve reliability, supportability and vehicle survivability. The flying qualities specification will be expanded to include large aircraft such as bombers, missile carriers, and transports in the million pound plus class.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #2403

Program Element: #62201P

DOD Mission Area: Engineering Technology (ED), #523

Title: Flight Control

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in thousands):

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	5,350	6,200	6,600	10,900	Continuing	Not applicable

8. (U) Comparison with FY 1981 Budget Data: (\$ in thousands)

RDT&E Funds	5,600	7,000	8,100	Continuing	Not applicable
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Project: #2404

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aeromechanics

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to initiate and conduct technology programs in the areas of aerodynamics, aerothermodynamics, performance analysis, configuration research, technology assessment and integration, and wind tunnel and flight experiments. These technology programs are directed toward improved mission capability, reduced development risk, and reduced development and operation cost. Fundamental technology base efforts include test and prediction techniques, design criteria, wind tunnel simulation, and flight test correlation

(U) RELATED ACTIVITIES: This project receives inputs from Defense Research Sciences (PE 61102F) and from Materials. (PE 62102F), as well as from the products of other national and international research and development activities. In turn, the output of this program is applied to Flight Vehicle Technology (PE 63205F), Advanced Fighter Technology Integration (PE 63245F), and other advanced development, engineering development, and system development programs. Joint and cooperative projects are conducted with other laboratories, other Air Force organizations, the Army, the Navy, National Aeronautics and Space Administration, and foreign countries. Coordination and avoidance of duplication of effort is accomplished with these agencies, academic institutions, and industry through exchange of information, coordinating and advisory groups, technical reviews and seminars, professional societies and meetings, and in the preparation of formal Department of Defense documents such as Technical Area Descriptions.

(U) WORK PERFORMED BY: Work under this program is performed in-house by the Flight Dynamics Laboratory and under contracts managed by that laboratory. Use is made of in-house facilities and the facilities of other Air Force organizations, other government organizations, and industry. The ten major contractors are: The Boeing Company, Seattle, WA; Rockwell International, Los Angeles, CA; McDonnell Douglas Astronautics - East, St. Louis MO; McDonnell Douglas Corporation, St. Louis, MO; Grumman Aerospace, Bethpage, NY; General Dynamics, Fort Worth, TX; Lockheed Aircraft, Marietta, GA; Science Applications Inc., LaJolla, CA; Centro Corporation, Dayton, OH; Lockheed Missile and Space Co., Huntsville, AL. Currently there are 22 total contractors and 53 total contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Computer simulations of self-excited unsteady aerodynamic phenomena have demonstrated a new and powerful analytic tool. Conventional aerodynamic prediction techniques have been expanded to include carriage and separation of conventional and advanced weapons. A significant inlet flow distortion problem on the Air Launched Cruise Missile was identified analytically. An independent analysis of the Space Shuttle uncovered design deficiencies which were later confirmed by wind tunnel tests. An in-house technology assessment was completed on the technology requirements for a Vertical/Short Takeoff and Landing (V/STOL) aircraft. Life cycle cost prediction techniques applicable to conceptual designs have been developed.

Project: #2404

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aeromechanics

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: Analysis techniques to extend conventional wing-body aerodynamic prediction to configurations with multiple lifting surfaces such as canards or tail in addition to wings. Current techniques assume the canard or tail provides trim and control forces only. Linear aerodynamic analysis techniques will be extended to include propulsive effects. A technology assessment will be initiated to determine which technologies could significantly impact large aircraft performance. Potential future applications of large vehicles include transports and cruise missile carriers. Ongoing efforts to improve aerodynamic prediction techniques, analyze technologies applicable to tactical aircraft and missiles, and collection of configuration test data to verify prediction techniques will continue.

3. (U) FY 1982 Planned Program: An effort to study volumetrically efficient bi-conic reentry vehicle (RV) aerodynamics will be expanded to include advanced configurations of maneuvering RVs and lifting orbiter vehicles. The results will be assembled in a design guide or handbook. Prediction techniques will be explored for air launched highly maneuverable missile aerodynamics. Tests will be conducted to gather data which will verify and validate aerodynamic heating prediction techniques. Currently only simple shapes such as RVs and missiles can be predicted with confidence. Studies will be initiated to assess technical problems of internal weapons bays. Reduced radar cross section and higher speed operation drive the design toward internal weapons carriage. However, little is known about weapon/weapon-bay aerodynamics except at moderate and low subsonic speeds. Advanced strategic aircraft configurations will be investigated for vehicles with increased range, payload, survivability and reduced life cycle cost. Technologies will be explored which offer solutions to the problem of sustaining combat operations off of damaged runways and alternate surfaces.

4. (U) FY 1983 Planned Program: A new effort will be initiated to define a low cost technology mini remotely piloted vehicle (RPV) or drone. The effect of observables on aerodynamically configured missiles will be assessed. Continue the assessment of flight vehicle concepts for effectiveness of standoff ballistic glide and cruise weapons. The evaluation will include costs as well as mission effectiveness. Continue the refinement of aerodynamic and mission performance prediction techniques which are efficient users of computer time and resources. An effort to correlate actual flight data, wind tunnel test results and analytic predictions will be completed. Aircraft and missile performance prediction techniques will be brought closer together to allow aircraft/missile performance trades which will maximize weapon system performance.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2404

Program Element: #62201F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aeromechanics

Title: Aerospace Flight Dynamics

Budget Activity: Technology Base, #1

7. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	7,703	7,900	8,500	9,200	Continuing	Not Applicable

8. (U) Comparison with FY 1980 Budget Data: (\$ in thousands)

RDT&E Funds	7,500	9,900	12,000	-	Continuing	Not Applicable
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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62202F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Program to Completion
TOTAL FOR PROGRAM ELEMENT							
06CH	Aerospace Medical Division	17,824	18,596	19,659	20,147		
	Laboratory Operations						
2729	Chemical Defense		929	800	800		
6302	Occupational and Environmental	2,400	2,769	3,200	4,200		
	Toxic Hazards in Air Force Operations						
6770	Biotechnology Studies in Advanced Systems	42	144	441	453		
6893	Manned Weapon Systems Effectiveness	1,588	2,000	2,400	3,500		
7184	Man-Machine Integration Technology	2,800	3,025	4,000	5,300		
7231	Safety and Aircrew Effectiveness in Mechanical Forces Environments	2,480	2,450	2,700	3,800		
7755	Aerospace Medicine	640	875	800	1,200		
7757	Radiation Hazards in Aerospace Operations	2,399	3,600	4,200	5,400		
7930	Advanced Crew Technology	1,707	1,212	2,500	3,400		

*Does not include pay raise.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Biotechnology is the core Air Force technology base program which enhances performance of weapon systems and operations through optimization of the human component. The program includes investigations into the protection of man in hazardous operations and man-machine integration technology for system design and operation. The program funds the operational support and management for the research and development activities performed by the Aerospace Medical Division, Brooks AFB TX. This includes the Air Force Aerospace Medical Research Laboratory, Wright-Patterson AFB OH, and the USAF School of Aerospace Medicine, Brooks AFB TX.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Major new thrusts include development of cockpit design criteria to improve pilot performance in single-seat, air-to-ground missions in all-weather and night conditions; the determination of biological effects, exposure hazards, and safety criteria to limit personnel health risk associated with electromagnetic systems; and, the development of a performance data base for aircrews operating in a chemical warfare environment. Previously described multiyear efforts will be continued.

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Program Element: #62202F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

<u>Project Number</u>	<u>FY 1980 Estimate</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E	31,000	35,800	39,800		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Military Construction

5,800 750

Includes the FY 1982 addition and alteration to the Biotechnology Laboratory at the Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base OH. Project provides modernized facilities in support of strategic crew station and tactical cockpit display/control developments and standards. FY 1983, Quarantine Support Facility at the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, provides space for Research and Development animal quarantine to rid animals of disease and stabilize animals before initiation of controlled research.

Program Element: #62202F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Biotechnology is the integrated Air Force program to optimize the role of the human operator in the design, development, and operation of increasingly complex and technologically sophisticated weapons systems. The three key parts of the biotechnology program are to define the safe limits of operator performance in extreme operational environments; to develop protective concepts and equipments which extend the performance capabilities; and, to develop man-machine interface criteria which optimize total systems performance and effectiveness. The products of this program are applied primarily to corollary hardware development programs in the mission areas of strategic offense and defense; tactical air superiority; tactical interdiction; command, control, and communications; and, intelligence. In addition, technology products from efforts in bioeffects of radiofrequency radiation, lasers, chemical propellants, and aircraft/missile noise are used to form national consensus standards and to assure environmental compatibility of fielded and developmental weapons systems. Several key factors drive the increasing investment in this program. These include: reliance on more technology rich hardware systems to counter the numerical superiority of threat systems; the requirement to reduce life cycle costs of weapons systems; the national environmental concern with lifetime effects of exposure to various forms of radiation and chemicals; and, the need to retain operationally experienced aircrews. This program element provides technical support to other Air Force and DOD agency programs and receives partial reimbursement for the services provided.

(U) RELATED ACTIVITIES: The Biotechnology Program is formally coordinated with the other Services, Government agencies, industry, and the university community through numerous communications, conferences and agreements. These include topical reviews, the Electromagnetic Radiation Management Advisory Council, Training and Personnel Technology Conferences, Annual Conference on Environmental Toxicology, Triservice Aeromedical Research Panel, and several Joint Technology Coordinating Group working bodies. The program is also coordinated on an international basis through the Air Standardization Coordinating Committee, and several North Atlantic Treaty Organization groups including the Defense Research Group, Advisory Group for Aerospace Research and Development, and the Military Agency for Standardization. In addition, bilateral efforts have been established with friendly nations, particularly with the United Kingdom, in the area of chemical defense for aircrews. Within the Department of Defense, joint efforts have been established with the Army Aeromedical Laboratory and the Naval Medical Research Institute. Efforts responsive to Air Force Systems Command are specifically coordinated with the responsible Air Force product division, systems program office, or Air Force laboratory. Liaison is maintained with the Air Force operational commands. Support to the Air Force Surgeon General is provided on a continuing basis.

(U) WORK PERFORMED BY: The Biotechnology Program is conducted by the Aerospace Medical Division through its two laboratories: the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base OH. The in-house portion of the program is centered on unique, complex, man-rated experimental facilities which are generally not available in the aerospace industry or academic institutions. The contract portion of the program complements the in-house efforts. The 10 major contractors in FY 1981 are: Systems Research Laboratories, Inc., Dayton OH; University of California, Irvine CA; Technology, Inc., San Antonio TX; Southeast Center for Electrical Engineering Education, Auburn University, Auburn AL; University of Dayton, Dayton OH; University of Washington, Seattle WA; Texas A&M University, College Station TX; McDonnell Douglas Corporation, St. Louis MO; Raytheon Service Company, Burlington MA; and Dynalelectron Corporation, Albuquerque NM. There are an additional 70 contracts conducted by 60 contractors.

Program Element: #62202F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Biotechnology
Budget Activity: Technology Base #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Some of the products of this program include the following: completion of extensive hydrazine toxicological studies that established exposure limits for humans that proved a change-out of the current F-16 emergency power unit was not necessary, thereby avoiding at least \$100 million retrofit cost to the F-16 program; of 563 aeromedical evaluations performed on medically grounded aircrew members, 388 were recommended for return to flying status, resulting in an estimated savings of \$220 million in training costs. A new restraint system was evaluated for pilots who will be exposed to high lateral accelerations during unconventional flight regimes of the AFTI/F-16; development of a prototype high flow ready pressure anti-G valve that provides increased G tolerance to high performance aircrew members; contributed to the design and integration of the B-52 Offensive Avionics System modification; and, completed low-level radiofrequency radiation measurements in support of the Phased Array Warning System (PAVE PAWS) program.

2. (U) FY 1981 Program: The major new FY 1981 effort is the development of improved chemical warfare defense protection for tactical aircrew and flight line maintenance personnel. In addition, a new effort was started to investigate the long-term, low-power physiological and biochemical effects of radiofrequency radiation. A new effort to develop methods to counter the enemy's ability to effectively operate portable, surface-to-air missiles will also begin along with plans for development of voice activated control technology for the cockpit.

3. (U) FY 1982 Planned Program: The aircrew performance degradation associated with chemical warfare agents and antidotes will be investigated to quantify the aircrew ability to operate in a chemical warfare environment. In addition, decontamination techniques, medical operations and procedures, and detection equipment will be developed. Efforts will be started in the area of pulsed radiofrequency radiation to compare the relative effects of pulsed versus continuous wave radiofrequency radiation on such end points as biological cell kinetics, amino acids, and stress induced changes in lymphocyte distribution and function. Measures of pilot workload will be validated against tactical scenarios involving high threat, night, and all-weather, low-level flight. The toxicology program will begin its investigation into the health hazards associated with United States Air Force synthetic and shale derived fuels and propellants.

Changes are reflected in the FY 1982 program due to changes in the technical program emphasis, additive costs of the October 1980 civilian pay raise, and the overall goal to achieve a 5 percent real growth in the Exploratory Development Program. Chemical Warfare Defense is the major change in project 6893 and the new start program project 2729.

4. (U) FY 1983 Planned Program: New thrusts include expanding measurement techniques used to assess human limitations in threat defense from one-against-one scenarios to many-against-one scenarios. Other thrusts are: improvements in design factors for cockpit display and integration to enhance pilot workload and use of new avionics, and investigations into the molecular basis of hazardous chemical reactions with biological tissue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06CH

Program Element: #62202F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Medical Laboratory Operations
Title: Aerospace Biotechnology

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the resources to conduct the research and development activities of the Aerospace Medical Division at Brooks Air Force Base TX and its research and development laboratories. The project provides for the pay and related costs of civilian physicians, scientists, engineers and support personnel as well as for travel, transportation, rents, communications, utilities, laboratory supplies and unique equipment and other related costs needed to conduct biotechnology research and development. The program managed by the Aerospace Medical Division is one of research and exploratory development in biotechnology. The research and development efforts are designed to specifically define man's limits in regard to adaptability, survivability, and performance capabilities within his operational environment. These coordinated efforts form the basis for: (a) designing more effective weapon systems which capitalize on and enhance man's abilities; (b) developing realistic trade-off options in system design and mission planning to increase overall effectiveness and achieve economy of operations; (c) assuring maximum protection and survivability of aircrew consistent with mission requirements dictated by national objectives; and, (d) establish realistic criteria for selection and care of the military man to maintain a strong and viable Air Force fully responsive to operational requirements and national goals.

(U) RELATED ACTIVITIES: This project accounts for about 51 percent of the funds of the exploratory development program which is predominantly conducted by specialized scientific teams using complex, unique research facilities and devices. Related activities are discussed in the Descriptive Summary for the overall program element.

(U) WORK PERFORMED BY: The Aerospace Medical Division has overall program responsibility and delegates project management to the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.
2. (U) FY 1981 Program: Not applicable.
3. (U) FY 1982 Planned Program: Not applicable.
4. (U) FY 1983 Planned Program: Not applicable.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #06CH

Program Element: #62202F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Aerospace Medical Laboratory Operations

Title: Aerospace Biotechnology

Budget Activity: Technology Base #1

7. (U) Resources: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>Fy 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Program to Completion</u>
Research, Development, Test and Evaluation Funds	17,824	18,596	19,659	20,147	Continuing	Not Applicable

8. (UP) Comparison with FY 1981 Budget Data:

Research, Development, Test and Evaluation Funds	17,329	18,000	18,200	Continuing	Not Applicable
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Changes are reflected in the FY 1982 program due to the 1 October 1980 civilian pay raise.

(112)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62203F

Title: Aerospace Propulsion

DOD Mission Area: Engineering Technology (ED), #523

Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		48,777*	51,900*	55,000	72,000	Continuing	Not Applicable
06CL	Laboratory Operations	14,475	14,185	15,727	16,093	Continuing	Not Applicable
3012	Ramjet Technology	5,461	5,830	5,552	8,440		
3048	Fuels, Lubrication & Fire Protect	7,070	7,718	7,948	9,847		
3066	Turbine Engine Technology	14,482	16,568	17,190	24,700		
3145	Aerospace Power Technology	7,212	7,599	8,583	12,920		
* Reflects recent reprogramming action of +\$77 thousand.							

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element develops the propulsion and power technology in support of current and future aerospace vehicles and weapons systems. Exploratory development and component/subsystem evaluations are conducted in the technical areas of turbine engines, ramjet engines, fuels, lubrication, and fire protection technology as well as aerospace power generation, distribution and control technology. The program also provides for the operation and management of the Aero Propulsion Laboratory at Wright-Patterson Air Force Base, OH.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The major emphasis in FY 1982 will be in the following areas. The durability of turbine engines will be increased and advanced components developed. An advanced high pressure ratio compressor will be developed. Efforts on advanced engine components, component integration and advanced control logic and integration will be initiated. Efforts to develop an advanced cruise missile fuel control and to define the operating limits of maneuver tolerant tactical inlets will be undertaken. Previously described multi-year efforts will be continued.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	46,500	53,500	60,100		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Both contractual and in-house efforts will be accomplished. The turbine engine programs are geared to development and test of engine components and subsystems for timely inclusion in core gas generators and system responsive advanced development programs. The ramjet programs are designed toward making major technology thrust in solid fueled ducted rockets and low cost ramjet propulsion systems for tactical missiles while continuing support of strategic air launched missiles. Aerospace power programs are geared toward advancing electrical, thermal, hydraulic, and mechanical power for USAF space systems, reentry vehicles, manned aircraft, missiles, munitions, and special high power systems. The area of fire protection concentrates on timely developments of effective fire prevention, detection, containment and suppression technology with minimum penalty to the prime mission. Aircraft and missile fuels and lubrication technology explores advancement of knowledge in combustion and lubrication phenomena in modern air breathing systems with a goal of improving efficiency and durability. To minimize cost and maximize availability of jet fuels, major projects in specification variability testing and alternate fuels will continue to receive increasing emphasis. This program element, in addition to being the primary technical base exploratory development effort in aerospace propulsion and power, provides technical support to other Air Force and DOD agency programs and receives partial reimbursement for the services provided. In the case of basic research accomplished by the laboratory, full reimbursement is provided by PE 61102F, Defense Research Sciences. The project break reflects the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: This program receives information and technology from PE 61102F, Defense Research Sciences. It interacts with other exploratory development program elements and feeds PE 63202F, Aircraft Propulsion Subsystem Integration; PE 63211F, Aerospace Structural Materials; PE 63215F, Aviation Turbine Fuels Technology; PE 63216F, Advanced Turbine Engine Gas Generator; PE 63302F, Advanced Missile Propulsion; and others. Coordination with Army, Navy, National Aeronautics and Space Administration, Department of Energy, Department of Transportation, Environmental Protection Agency, industry and academia is accomplished by joint projects, information exchanges and standing committees, such as the Interagency Power Group and the National Aeronautics and Space Administration/Air Force semi-annual meetings.

(U) WORK PERFORMED BY: Work is managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Other Air Force organizations involved are the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH; the Space Division, Los Angeles, CA; and Armament Division, Eglin Air Force Base, FL. The ten major contractors for the program in FY 1980 are: Cadre Corporation, Doraville, CA; General Motors Corporation, Indianapolis, IN; Garrett Corporation, Phoenix AZ; United Technologies Corporation, East Hartford, CT; General Electric Corporation, Cincinnati OH and Long Beach, CA; Hughes Aircraft Corporation, Los Angeles, CA; Systems Research Laboratory, Inc., Dayton, OH; and University of Dayton, Dayton, OH. There are 86 contractors with 218 contracts.

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Conducted a durability test of the shingle liner combustor, demonstrated carbon-carbon applications, and demonstrated performance of advanced compressor and combustors for transition to advanced technology demonstrators. Completed freejet tests of ramjet engines for the Advanced Strategic Air Launched Missile mission and tactical air-to-air missiles. Flight tested JP-9 fuel for the Air Launched Cruise Missile and began production of on-specification shale JP-4 fuel for component testing. Extended the operational life of the N1-Cad battery from one year to four years for satellites. Demonstrated a high performance aircraft auxiliary power unit and demonstrated a high efficiency (17%) solar cell for space. Invented emergency backup fuel pump for F-16.
2. (U) FY 1981 Program: The Compressor Research Facility will become operational in early FY 1981 and in-house testing will begin. Turbine engine programs will emphasize advanced augmentor for Joint Technology Demonstrator Engine/Variable Cycle Engine, full scale segmented ceramic combustors, high tip speed fan, multivariate control logic, and structural durability improvements for large and small engines. Ramjets will demonstrate variable flow ducted rocket and solid fueled ramjets for tactical missiles and develop methods to eliminate hazardous debris and exhaust emissions. New efforts will develop high-energy density hardened batteries for satellites and intercontinental ballistic missiles, extended survivable power and special weapon power. Improve processing technology to increase production of shale derived fuels and conduct tests to determine shale fuel effects on turbine engine components.
3. (U) FY 1982 Planned Program: Multi-year efforts will continue. In addition to the continuing efforts, new programs will be initiated to assess the Joint Technology Demonstrator Engine structural durability, investigate a high bleed compressor for possible Vertical/Short Takeoff and Landing and high power applications, and demonstrate an advanced centrifugal and axial/centrifugal compressor. Ramjets will complete development for a fixed fuel-flow ducted rocket and develop improved components for ducted rockets, solid fuel ramjets and strategic missile propulsion systems. Fuels Division will complete tests of fuel property effects on fuel systems and combustors. The cost difference from the FY 1981 Descriptive Summary will cause the elimination or delay of several new efforts in all areas and are described in the individual project summaries.
4. (U) FY 1983 Planned Program: Many of the above programs are multi-year continuing efforts. New programs will be initiated to demonstrate advance ramjet components and fuels in direct connect tests, demonstrate high power density, 10 year life, survivable power systems in the multi-threat environment, define modifications required to turbine engine components to preclude degradation when using shale derived or lesser quality fuels. Turbine engine programs will define realistic test procedures to permit accurately assessing turbine durability during the engine development process.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #06CL

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aero Propulsion Laboratory Operation

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Aero Propulsion Laboratory's exploratory and advanced development programs. The laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. The project provides for the pay and related costs for civilian scientists, engineers, and supporting personnel, travel, transportation, rents, communications and utilities costs, procurement of supplies and equipment, and contractor support service.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element, as well as all other projects and programs managed by the Aero Propulsion Laboratory, such as PE 63202F, Advanced Propulsion Subsystem Integration; PE 63215F, Aviation Turbine Fuels Technology; PE 63216F, Advanced Turbine Engine Gas Generator; and others. Direct costs incurred by these advanced development programs are reimbursed by these programs to this project.

(U) WORK PERFORMED BY: The Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for management of the projects included under the program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable.
2. (U) FY 1981 Program: Not Applicable.
3. (U) FY 1982 Planned Program: Not Applicable.
4. (U) FY 1983 Planned Program: Not Applicable.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.
7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Estimate to Completion	Total Estimated Costs
	14,475	14,185	15,727	16,093	Continuing	Not Applicable

RD6E

Project: #06CL

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aero Propulsion Laboratory Operation

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RD&E	13,200	14,200	14,400	Continuing		

Changes reflected in the FY 1982 program are due to the 1 October 1980 civilian pay raise.

Project: #3012

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Ramjet Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops ramjet component and engine technology to improve performance and reduce costs of strategic and tactical air-launched missiles, drones, and remotely piloted vehicles. Ramjet propulsion concepts being evaluated include: a liquid fuel integral rocket-ramjet for volume limited long-range high-speed missiles; various ramjet configurations for simple inexpensive tactical missiles utilizing solid fuels; and a gas generator fueled "ducted rocket." These efforts include component development of inlets, combustors, nozzles, fuel controls, and engine technology demonstrators. Emphasis is on solid fueled ducted rockets and low cost tactical ramjet systems.

(U) RELATED ACTIVITIES: This program is closely coordinated and includes jointly funded efforts with: the Navy on solid fuel ramjets; the Air Force Rocket Propulsion Laboratory on ducted rockets and the Materials Laboratory on engine structures. Ramjet technology supports the requirements of PE 63313F, Advanced Missile Subsystems Demonstration; and PE 63302F, Advanced Missile Propulsion. This program focuses on the propulsion requirements of the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, and the Armament Division at Eglin Air Force Base, FL. Program coordination is maintained through meetings, conferences and the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee.

(U) WORK PERFORMED BY: This project's in-house and contractual efforts are managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. The contractors in FY 1980 were: The Marquardt Co., Van Nuys, CA; Chemical Systems Division of United Technologies Corporation, Sunnyvale, CA; McDonnell Douglas, St. Louis, MO; Williams Research Corporation, Wall Lake, MI; Atlantic Research Corporation, Alexandria, VA; Hercules, McGregor, TX. These contractors were involved in 26 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Significant accomplishments have been achieved in high temperature ramjet combustors, solid fuel ramjets, and ducted rockets. Freejet testing of ducted rockets have been accomplished. Component development of variable fuel flow ducted rockets was initiated. Freejet testing of advanced liquid fueled ramjet engines for strategic application was completed. Component development for advanced cruise missile inlets and nozzles, low cost fuel controls and evaluation of advanced fuels was initiated.
2. (U) FY 1981 Program: Advanced high speed combustor development, combustor instability investigations and low radar cross section inlet efforts will be initiated to support strategic systems. An advanced solid fueled ramjet engine development, inlet stability investigation, plume signature reduction program, and non-ejectable inlet cover and exhaust nozzle development will be initiated. Other ongoing programs will be continued.
3. (U) FY 1982 Planned Program: The major emphasis on solid fueled ramjet and ducted rocket development for tactical missile applications will continue. New programs to develop an advanced cruise missile fuel control and to define the operating limits of maneuver tolerant tactical inlets will be undertaken. Advanced liquid fueled component development

Project: #3012

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Ramjet Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

will be transitioned to a strategic missile engine development. Other multi-year ongoing efforts will be continued. The decrease from the FY 1981 Descriptive Summary reflects a delay in initiating new efforts to develop a second source for the ducted rocket engine.

4. (U) FY 1983 Planned Program: Programs described above and others will continue. Liquid fueled ramjet engine development will be initiated for an advanced strategic missile application. An advanced high energy solid fueled ramjet effort and a large scale high energy fuel ducted rocket engine will be emphasized.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	5,461	5,830	5,552	8,440	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	4,900	5,600	6,400	Continuing	Not Applicable
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Project: #3048

Program Element: #62203F

DOD Mission Area: Engineering Technology (AD), #553

Title: Fuels, Lubrication & Fire Protection Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Efforts under this project are oriented toward providing fuels management technology, lubricants and lubrication techniques, bearing and gear technology, and fire protection methods and techniques which will satisfy the stringent requirements of present and future weapons systems. Approaches to meet the objectives of this project include the evaluation of fuels from sources other than petroleum, development of fuels and lubricants with improved high temperature characteristics, development of advanced fuel management concepts and lubrication techniques, development of advanced bearing and gear concepts; and development of hazard protection capability for the effective prevention and control of fire and explosion associated with flight vehicle combustion.

(U) RELATED ACTIVITIES: This project provides technology for PE 62102F, Materials; PE 63202F, Aircraft Propulsion Subsystem Integration; PE 63215F, Aviation Turbine Fuels Technology; and PE 63216F, Advanced Turbine Engine Gas Generator. Coordination with the Army, Navy, National Aeronautics and Space Administration, the Defense Fuel Supply Center, the Fuels and Lubricants Standardization efforts of the North Atlantic Treaty Organization and the Department of Energy is accomplished by a broad spectrum of interactions and exchanges.

(U) WORK PERFORMED BY: The work is managed and performed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. The 10 major contractors for FY 1980 were: Systems Research Lab, Inc., Dayton, OH; AiResearch Manufacturing Co., Phoenix, AZ; McDonnell Douglas Corp., St. Louis, MO; General Electric, Cincinnati, OH; Ashland Oil Co., Ashland, KY; Monsanto Research Corp., Dayton, OH; The Boeing Company, Seattle, WA; Sun Oil Company, Marcus Hook, PA; United Technologies Corp., West Palm Beach, FL; and University of Dayton, Dayton, OH. There were 26 contractors and 44 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The technology developed under this project has led to the qualification of Department of Defense fuels and lubricants such as JP-4, JP-5, JP-7, JP-8 (the NATO standard fuel), JP-9, and JP-10. An anti-static electricity additive has been developed and incorporated into JP-4 and JP-8 thereby eliminating an explosive refueling problem. Experimental work has been conducted on fuel tank fire and explosion vulnerability to high energy lasers. Representative Air Force turbine engine components have undergone preliminary screening tests which alternate fuels. A new ramjet fuel (RJ-6) specification for the Advanced Strategic Air Launched Missile was developed to provide better low temperature properties. Non-conventional combustion process work such as reforming to reduce carbon formation, thereby reducing smoke, has been initiated.
2. (U) FY 1981 Program: New efforts include additional alternate fuels programs to accelerate this critical technology base, development of a portable wear metal analyzer for field use, corrosion resistant engine bearing development, advanced cylindrical roller bearing development, solid lubricant ceramic bearing development and development of an aircraft fuel leak safety meter. Multi-year programs initiated earlier will continue.

Project: #3048
 Program Element: #62203F
 DOD Mission Area: Engineering Technology (ED), #523
 Title: Fuels, Lubrication & Fire Protection Technology
 Title: Aerospace Propulsion
 Budget Activity: Technology Base, #1

3. (U) FY 1982 Planned Program: Tests will be completed of the fuel property effects on fuel systems and combustors. Ongoing multi-year efforts in fuels development, lubrication and fire protection will continue. Turbine engine component testing with shale derived fuels will continue. Reduced funding will preclude any new starts in this area. The difference from the FY 81 Descriptive Summary reflects the elimination or delay of new efforts in fire detection and suppression for dry bay areas, advanced cooling techniques for engine bearings, development of foil bearings and advanced fuel tank design criteria.

4. (U) FY 1983 Planned Program: Efforts will continue to define and refine specifications for shale derived fuels. Turbine engine component testing will define component modifications required to allow the operation of these engines with shale derived or lesser quality fuels. Advanced technology new efforts will be initiated in areas of aircraft and missile, fuels, lubricants and fire protection suppression. Most efforts previously described will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	7,070	7,718	7,948	9,847	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	FY 1981 Actual	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,700	9,100	9,600	Continuing	Not Applicable

Project: #3066

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Turbine Engine Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops technology to achieve the major turbine engine goals which include: increased operational reliability, cycle flexibility and performance; and reduced fuel consumption, weight, acquisition and operational costs. Analytical and experimental efforts to achieve these objectives address: fans and compressors, high temperature combustors, turbines and seals, controls, diagnostics, mechanical design techniques and environmental considerations. The project considers the total propulsion system (inlet, engine, nozzle) and its integration into a weapon system.

(U) RELATED ACTIVITIES: This project is coordinated with the Army, Navy, National Aeronautics and Space Administration, Department of Energy, and the Department of Transportation in meetings, inter-service committees and headquarters staff coordination. Component advancements are integrated into PE 63202F, Advanced Propulsion Subsystem Integration; and PE 63216F, Advanced Turbine Engine Gas Generator. Jointly funded programs with the Navy, National Aeronautics and Space Administration and the Materials Laboratory are developing advanced turbine engine component technology for future applications.

(U) WORK PERFORMED BY: Work is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. The ten major contractors in FY 1980 were: Cadre Corporation, Doraville, GA; Pratt and Whitney Aircraft, Division of United Technologies Corporation, East Hartford, CT and West Palm Beach, FL; Garrett Corporation, Los Angeles, CA and Phoenix AZ; General Electric Company, Evendale, OH and Lynn MA; Detroit Diesel Allison Division of General Motors, Indianapolis, IN; Calspan Corporation, Buffalo, NY; McDonnell Douglas Corporation, St. Louis, MO; Systems Control, Inc., Palo Alto, CA; and Williams Research Corporation, Wall Lake, MI. There are 20 contractors with 85 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Significant accomplishments included the demonstration of the advanced "high through-flow" compressor concept; extensive testing to validate the durability and maintainability of the shingle liner combustor; development of a high pressure single stage centrifugal compressor; and the adoption by industry of a validated three-dimensional stress analysis to improve turbine blade mechanical reliability. Demonstrated the application of carbon-carbon to advanced components and transitioned advanced compressors and combustors to technology demonstrators. Additionally, contractor acceptance, through independent testing, of several in-house theoretical models will help define life cycle cost and performance. Development emphasis has been directed toward improved mechanical design and analysis methods, test techniques, design criteria, and development of procedures necessary to the achievement of improved structural durability and life.

Project: #3066

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Turbine Engine Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: In-house testing will begin in FY 1981 when the Compressor Research Facility becomes operational. Emphasis will be on an advanced augmentor for Joint Technology Demonstrator Engine/Variable Cycle Engine, a full scale segmented ceramic combustor, a high tip speed compressor, multivariate control logic, and structural durability improvements for large and small engines. Other new efforts will include Variable Cycle Engine heat transfer investigations and a combustor inlet diffuser performance evaluation. Other multi-year efforts will continue.

3. (U) FY 1982 Planned Program: New programs will be initiated to assess Joint Technology Demonstrator Engine structural durability assessment, investigate a high bleed compressor for possible Vertical/Short Takeoff and Landing and high power application, and demonstrate a centrifugal and axial/centrifugal compressor with a 15-25 pressure ratio. Other new initiatives will investigate advanced engine components, component integration and advanced control logic and integration. Multi-year ongoing efforts will continue. The cost difference from the FY 1981 Descriptive Summary reflects a two-year delay in controls integration for advanced engine, the elimination of efforts in advanced combustor materials, compressor temperature distortion investigations and critical component identification for advanced engines. Several other new efforts have been reduced in scope and delayed.

4. (U) FY 1983 Planned Program: Turbine engine programs will define realistic test procedures to permit accurately assessing turbine durability during the engine development process. An effort will be initiated to define the modifications required for turbine engine components to preclude degradation when operated on shale derived or lesser quality fuels. Other new efforts include an advanced variable geometry compressor, variable cycle control logic verification, advanced controls integration, advanced components for small turbine engines, and improved components to improve hot section durability.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,559	16,568	17,190	24,700	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	15,000	16,900	20,300	Continuing	Not Applicable
RDT&E					

Project: #3145

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Power Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project includes the development of solar power, fuel cells, batteries, hydraulics and power conversion, conditioning and transmission for both space and non-space applications. These analytical and experimental efforts form a balanced, broad base in power subsystem technology responsive to anticipated needs of aeronautical, missile, space and electronic systems including special ground power needs. General goals of these are increased power output, decreased weight and volume, decreased vulnerability, increased life and reliability, increased tolerance to environments, and provision of effective options in technology and capabilities for future systems application in the conceptual phase. The Aero Propulsion Laboratory provides a single point of technical management for these programs within the Air Force. A strong technological base has been established for these efforts by extensive work in prior fiscal years. This program emphasizes chosen options for specific power subsystem technologies to provide improved capabilities for near-term applications and more advanced technology for long-term Air Force power demands.

(U) RELATED ACTIVITIES: The Army, Navy, Department of Transportation, Department of Energy, and National Aeronautics and Space Administration have exploratory development programs in areas related to this project to support their respective and unique requirements for systems and supporting subsystems. Coordination is maintained at all levels through symposia, meetings, professional associations and the Interagency Advanced Power Group. This program receives inputs and provides technology for PE 61102F, Defense Research Sciences; PE 62102F, Materials; PE 62204F, Aerospace Avionics; PE 62601F, Advanced Weapons; PE 63401F, Space Vehicle Subsystems; PE 63605F, Advanced Radiation Technology; and PE 63723F, Civil and Environmental Engineering Technology.

(U) WORK PERFORMED BY: Work is managed and performed by the Aero Propulsion Laboratory at Wright-Patterson Air Force Base, OH. Other Air Force organizations involved are the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, and the Space Division, El Segundo, CA; Ballistic Missile Office, San Bernardino, CA; and the Air Force Engineering and Services Center, Tyndall Air Force Base, FL. The ten major contractors are: Eagle Picher Industries, Inc., Joplin, MO; Teledyne CAE, Toledo, OH; General Electric Company, Erie, PA; Rockwell International Corporation, Canoga Park, CA; Garrett A/R Research Manufacturing Company, Phoenix, AZ; Westinghouse Corporation, Pittsburgh, PA; Boeing Aerospace Co., Seattle, WA; University of Dayton, Dayton, OH; Magnetic Corp. of America, Sunnyvale, CA; and Hughes Aircraft, Los Angeles, CA. There are 32 contractors with 63 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Representative accomplishments under this program include the development of a permanent magnet aircraft generator which is much simpler and more reliable than conventional devices, the demonstration of an advanced solar cell which is more efficient than any currently used device and the transition to industry of a revolutionary cell separator material for nickel-cadmium battery which eliminates the dangerous "thermal runaway" problem in aircraft batteries. Advances in high power technology have included demonstration of a lightweight Magneto-hydrodynamic channel, inverters and switches. System level specifications for high power equipment have been written which will now become the industry standard. Metal-gas batteries for space applications are transitioning to Advanced Development. A spacecraft solar cell hardening program was initiated.

Project: #3145

Program Element: #62203F

DOD Mission Area: Engineering Technology (ED), #523

Title: Aerospace Power Technology

Title: Aerospace Propulsion

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: New efforts will initiate development of high energy density hardened batteries for satellites and Intercontinental Ballistic Missiles, extended survivable power and special weapon power. Other initiatives include evaluation of advanced fuel cells and development of an advanced cruise missile power system.

3. (U) FY 1982 Planned Program: Previously described multi-year efforts will continue. Budget constraints will preclude initiating any new efforts in this year. The cost difference from the FY 1981 Descriptive Summary reflects the elimination of new starts in special high power systems, advanced aero auxiliary power and fire resistant hydraulic systems.

4. (U) FY 1983 Planned Program: Multi-year efforts previously described will continue. New programs will demonstrate high power density, 10 year life, survivable power systems in a multi-threat environment. New efforts are planned in advanced aero auxiliary power units, hardened solar cells and high density, high energy spacecraft batteries, and advanced auxiliary ground power systems.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E	7,212	7,599	8,583	12,920	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data</u> :						
RDT&E	6,700	7,700	10,400	Continuing		Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62204F

Title: Aerospace Avionics
Budget Activity: Technology Base, #1

DOD Mission Area: Electronics & Physical Sciences (ED), #521

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	55,087	56,700	64,600	76,900	Continuing	Not Applicable
060Q	Air Force Avionics Laboratory Operations	20,798	23,285	25,446	25,852		
2000	Active Electronic Counter-measures	3,238	3,300	4,000	6,550		
2001	Electro-Optical Technology	2,993	2,845	3,300	4,100		
2002	Microwave Technology	5,978	5,700	6,700	8,300		
2003	Avionic System Design Technology	3,978	3,940	4,400	5,200		
2004	Technology for Reconnaissance and Targeting Avionics	2,095	2,110	2,600	3,700		
6095	Inertial Reference and Guidance Technology	2,072	2,100	2,200	2,500		
6096	Microelectronics Technology	4,207	4,000	4,100	4,900		
7622	All-Weather Recce/Strike Avionics	2,748	3,250	4,554	6,800		
7629	Fire Control Avionics	3,013	2,300	2,500	2,800		
7633	Passive Electronic Counter-measures	2,815	2,710	3,500	4,700		
7662	Avionic Data Transmission and Reception	1,152	1,160	1,300	1,498		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops avionics technology which improves the function of aerospace vehicle command, control, navigation, penetration, defense, reconnaissance, fire control, and weapon delivery. Increasing threats; rising acquisition operations and maintenance costs; aging equipment in the inventory; and a vast increase in technological opportunity; all dictate the need for developing improved avionics capabilities. These improvements will result in better performance, lower life cycle cost, higher reliability and greater mission effectiveness. The program also provides for the operations and management of the Air Force Avionics Laboratory at Wright-Patterson Air Force Base, OH.

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program pursues technological advances in avionics components, subsystems, and systems to improve mission effectiveness, reduce life cycle costs, and improve avionics reliability. Important activities receiving increased emphasis in FY 1982 include: work on key synthetic aperture radar technologies to develop a covert, in-weather receive/strike capability to significantly increase strike aircraft survivability; development of a modular, solid-state, phased array radar technology which promises both the multifunction, agile beam capability needed by the next generation of strike aircraft, and a factor of over 100 reliability improvement over current traveling wave tube radar systems; and work on laser three-dimensional classification technologies which are opening up the possibility of laser radar and automatic target detection and classification to allow more covert operation in forward battle areas and greatly reduce the time it takes for a pilot to find and put a weapon on tactical targets.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	55,200	56,800	58,800		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Military Construction

12,900

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The ability of modern weapon systems to perform an assigned military mission is determined by their ability to: penetrate hostile defenses; detect, locate, and identify targets; and deliver weapons to those targets with accuracy and timeliness. Each of these functions is directly dependent on the quality and performance of the aircraft's avionics. This program develops the technology base upon which the avionics systems of the late 1980's and 1990s will rely. It is the program element for almost all Air Force exploratory development in avionics. Items developed range from devices such as integrated circuits, improved avionics components, gyroscopes and radar signal processors, to architectural concepts for integrated avionics subsystems. A set of seven major thrusts form the basis of the avionics investment strategy: Microelectronics Technology; Electro-optical Technology; Radar Technology; Communications, Navigation, Identification Avionics; Electronic Warfare System Technology; Support Software Technology; and System Integration, Analysis and Software Technology. Microelectronics Technology: The objectives of this thrust are to develop and advance the microelectronics technology base of electronic devices, modules, packaging techniques and subsystem designs which will significantly impact avionics equipment cost, power, reliability, and environmental tolerance. This thrust is very broad and includes exploratory development in: (a) high speed silicon and gallium arsenide signal processing elements, (b) high capacity magnetic bubble and nonvolatile semiconductor memories, (c) high speed module and line replaceable unit packaging techniques, (d) computer aided design techniques for affordable, testable, integrated circuit chips, device modules and subsystems, and (e) high speed signal processing techniques. Major payoff opportunities include: basic device building blocks for all avionics applications; quantum jumps in high speed signal and data processing; significant reductions in avionics system cost, size, weight, and power requirements; and increased system reliability and performance. Electro-optical Technology: The objectives of this thrust are to develop, improve the performance and reduce the cost of electro-optical technology for reconnaissance, surveillance, navigation, damage assessment, obstacle avoidance, target acquisition, fire control and weapon delivery applications. This thrust includes development in both electro-optical components and system technologies that will provide: (a) day/night and adverse weather target acquisition and weapon delivery; (b) automatic target cueing, detection, and classification techniques; (c) increased detection and recognition range of sensors; (d) medium power and frequency agile lasers in the 0.5 to 5.0 micrometers range; and (e) improved performance of single element detectors and detector arrays in the 0.3 to 14 micrometers wavelength range. Major payoff opportunities include: night and adverse weather strike; automatic target classification; increased detection and recognition ranges for improved survivability; decrease by factor of two in pod size; and improved performance for future systems. Radar Technology: The objectives of this thrust are to develop and demonstrate advanced radar theories, concepts, techniques, and devices for weapon delivery for strategic, tactical, and satellite applications. The scope of this thrust includes radar systems and components. In the systems area, advanced synthetic aperture radar technology will be directed at tactical precision strike applications as well as long range standoff with ultra-fine resolution to provide improved reconnaissance, surveillance, and weapon delivery capability. Long wavelength technology for foliage penetration, electronic counter-countermeasures and bistatic operation (receiver and transmitter in separate locations) for radar survivability, millimeter wavelength technology for improved terminal weapon delivery, and radar classification and identification technology for fixed and moving targets are areas to be

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DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

emphasized. In the radar system components area, efforts will be directed at developing techniques and/or processes that will result in improvements in performance, reliability, and cost. Advances in solid state sources, amplifiers, receiver/transmitter component technology, radio frequency signal control technology, solid state phased array antenna technology will be pursued. Major payoff opportunities include: night and all-weather "hit to kill" weapon delivery, high survivability of weapon delivery systems; automatic radar target classification; near real time reconnaissance/surveillance capability; and improved performance of microwave devices for future systems. Communications, Navigation, Identification Avionics: The objectives of this thrust are to develop and demonstrate cost-effective jam-resistant advanced communication (voice and data), navigation (radio and inertial) and non-cooperative Identification Friend, Foe, or Neutral technologies for aerospace vehicles and to effectively integrate these subsystems into an optimally configured, jam resistant communication, navigation, identification subsystem. Specific technologies being pursued under this thrust include: (a) developing common time-sharing signal processing techniques, (b) developing high accuracy strapped-down inertial technologies, and (c) techniques to integrate these technologies with communications and identification subsystems within a totally integrated avionics suite. This thrust also provides for the development and maintenance of in-house simulation and evaluation test facilities to support these efforts. Major payoff opportunities include: affordable anti-jam data links for aircraft, remotely piloted vehicles, and missiles; high accuracy and low cost inertial technology; and integration of communications, navigation, and identification functions. Electronic Warfare Systems Technology: The objectives of the Electronic Warfare systems technology thrust are to increase aerospace vehicle survivability in a hostile radio-frequency and electro-optical signal environment through exploratory development of countermeasure concepts, techniques, and equipment. Included in this objective are the development of automatic and self-programmable countermeasures systems, derivation and demonstration of new countermeasures techniques and the analysis and evaluation required to verify and validate the effectiveness of the technologies being developed. Specific technologies being developed include: (a) countermeasure techniques that are not threat sensitive but exploit the fundamental operational capability of developing threats, (b) radio frequency receivers which can detect and process complex radar modulations and signal formats, (c) optical signal detection techniques, (d) mixed mode radar and communication jamming for command, control and communication networks and ground controlled intercept radars, (e) vehicle signature control techniques, and expendable penetration aids. Major payoff opportunities include: improved survivability in heavily defended environments; reduced probability of intercept; dilution, confusion, denial, delay and jamming of defenses; and reduced electronic warfare system costs. Support Software Technology: The objectives of this thrust are to develop the off-board support software techniques and tools which will increase the systems maintainability, testability and reliability. This thrust will develop the technology which will result in a reduction in life cycle cost of avionics software. Included in this thrust are the development and evaluation of: (a) integrated avionics maintenance support concepts, (b) standard integrated systems for avionics software development, (c) models for estimating the life cycle costs of software systems, and (d) high level language machines and programming standards. This thrust complements the "System Integration, Analysis, and Software Technology" thrust. Major payoff opportunities include: increased software reliability; ease of verification; enhanced software maintainability and portability; increased management visibility of software development process; and a data base which will be used for analysis of software development costs. System

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Budget Activity: Technology Base, #1

Integration, Analysis & Software Technology: The objective of this thrust is to develop, evaluate and analyze the concepts and techniques which will provide for the effective integration of on-board hardware and software for a total avionics suite. This thrust includes (a) developing the methodologies for total avionics suite analysis necessary to quantify system mission effectiveness and life cycle costs; (b) developing the core system architecture techniques that will provide fast, low cost system updates and modifications; (c) providing the analyses and identification of core avionics standards; (d) developing avionics "hot bench" test capability; and (e) developing the avionics system software that optimally fuses on-board information to accomplish navigation, fire control, threat warning, countermeasures, command, control and communications, flight control, etc. Major payoff opportunities include: lower avionics system life cycle cost; enhanced avionics system effectiveness; mission flexibility and growth potential; standardization and interoperability of systems and subsystems; tools for analysis, synthesis, and evaluation of integrated avionics suites; and exploitation of synergistic performance of multiple sensor systems. This program element, in addition to being the only Air Force exploratory development effort in avionics technology, provides technical support to other Air Force and Department of Defense agency programs and receives partial reimbursement for the services provided. In the case of basic research accomplished by the Laboratory, full reimbursement is provided by Program Element 61102F. The project break reflects the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: Since this program is a broad technology base effort, technology transfer takes place between a large number of related program elements. The most significant of these, to or from which a significant number of efforts are transitioned, include: Defense Research Sciences, 61101E; Defense Research Sciences, 61102F; Materials, 62102F; Strategic Technology, 62301E; Command, Control, and Communications, 62702F; Advanced Avionics for Aircraft, 63203F; Reconnaissance Sensors/Processing Technology, 63208F; Space Vehicle Subsystems, 63401F; Advanced Space Communications, 63431F; Very High Speed Integrated Circuits, 63452F; Conventional Weapons, 63601F; Electronic Warfare Technology, 63718F; Advanced Communications Technology, 63727F, Air-to-Air Identification of Non-Cooperative Targets, 63742F; Electro-Optical Warfare 63743F; and Counter-Counter Measures Advanced Development, 63750F. Tri-Service and interagency coordination is continually accomplished. All electron device work is coordinated through the Advisory Group on Electron Devices which advises the Office of the Undersecretary of Defense for Research and Engineering. All work on fiber optics components and systems applications is coordinated through the Tri-Service Fiber Optics Coordinating Group. Developments in thermal imaging and imaging processing are coordinated through the Night Vision Technology Panel under the Joint Deputies for Laboratories Committee which, in turn, is under the Joint Logistic Commanders. A Tri-Service effort to standardize electronic countermeasures power chains and traveling wave tubes is occurring under Joint Development of Laboratories Commanders auspices. All electronic warfare efforts are coordinated through the Countermeasures Subgroup of the Aircraft Survivability Joint Technical Coordinating Group under the Joint Logistics Commanders. In addition, work in infrared countermeasures and missile launch detection is coordinated through an annual review by the Office of the Undersecretary of Defense for Research and Engineering. A joint Air Force-Army program to improve electronics reliability and maintainability through improved design methodology is proceeding under the Joint Technical Coordinated Group for Reliability, Availability and Maintainability. Ring laser gyro work is coordinated through the Joint Services Guidance and Control Committee under the Office of the Undersecretary of Defense for Research and Engineering.

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

The Naval Weapons Center and the Air Force Avionics Laboratory have a memorandum of agreement to develop a new concept of tail warning radar. The National Aeronautics and Space Administration and Avionics Laboratory are coordinating their magnetic bubble memory developments to prevent duplication. Avionics Laboratory, Navy, Army, and the Defense Advanced Research Projects Agency are cooperating in the development of mercury cadmium telluride focal planes for thermal imaging applications. In a cooperative effort with the Air Force Armaments Division, the Air Weather Service, and the Air Force Geophysics Laboratory, the Air Force Avionics Laboratory is measuring and storing in a common data base the effects of weather on atmosphere transmission of infrared radiation. These tri-Service coordinating groups and joint agreements provide the Aerospace Avionics program the means of aligning its efforts with those of the other Services. This permits the sharing of technical information and avoids wasteful duplication. Key program elements which are coordinated in this way include: Aircraft Avionics, 62202A; Electronic and Electron Devices, 62705A; Tactical Electronic Warfare Technology, 62715A; Aircraft Avionics Equipment, 63207A; Night Vision Investigations, 62709A; Night Vision Advanced Development, 63710A; Electron Device Technology, 62762N; Avionics, 63203N, and Advanced Electron Device Development, 63742N.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the work performed under this program. Specialized facilities operated by the Avionics Laboratory in support of this program include: The Electronic Warfare Anechoic Chamber, Electronic Defense Evaluator, Dynamic Electromagnetic Environment Simulator, Dynamic Analyzer, Computer-Aided Design Facility, Mobile Evaluation Laboratory, Reference System Software and Evaluation Laboratory, 100-inch Collimator, Laser Research Laboratory, Radar Reflectivity Measurement Facility, Targeting Systems Characterization Facility, Global Positioning System Evaluation Facility, Ring Laser Gyro Laboratory, Communications Systems Evaluation Laboratory, and Radar Signal Processing Laboratory. The ten major contractors were: Hughes Aircraft Company, Malibu, CA; Texas Instruments Incorporated, Dallas, TX; Goodyear Aerospace Corporation, Akron, OH; Raytheon Company, Waltham, MA; TRW Incorporated, Redondo Beach, CA; Systems Research Laboratories Incorporated, Dayton, OH; Environmental Research Institute of Michigan, Ann Arbor, MI; General Electric Company, Utica, NY; Northrop Corporation, Hawthorne, CA; and International Telephone and Telegraph Corporation, Nutley, NJ. In addition there were 96 other contractors located nationwide with 196 contracts. In all there were 329 contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The following are highlights from the Microelectronics Technology thrust. Enhancement mode and depletion mode gallium arsenide metal semiconductor field effect transistors have been fabricated using the electron-beam direct wafer write approach demonstrating that technology's availability for submicrometer minimum feature size gallium arsenide circuit fabrication. This is an important step in making use of gallium arsenide's high speed and radiation hardness characteristics in future aircraft and spacecraft signal processing. A high yield one micrometer (one thousandth the diameter of the period at the end of this sentence) gallium arsenide small scale integration fabrication process was demonstrated in-house. One megabit capacity magnetic bubble chips have been produced in high yield runs. The 16 megabit bubble memory brassboards have been evaluated and made available to potential users for magnetic bubble system evaluation. The magnetic bubble development effort has moved the technology closer to spacecraft and aircraft system applications where high density, nonvolatile memory, with no moving parts is badly

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

needed. Highlights in the Electro-Optical Technology thrust are as follows. Two projects (Real-Time 3 dimensional classifier, Active/Passive Cueing Techniques) successfully proved the technical feasibility of downward-looking, high accuracy, high speed target classification based on active 3 dimensional signatures. Phase I of the forward-looking active classifier technology project indicates the technology can be used in forward-looking applications. The system uses the 3 dimensional shape of objects which is more invariant and unique than other discriminants. This permits a high probability of tactical target detection with low false alarm rates and promises significant payoffs in improved reconnaissance/strike missions. The first practicable 20 watt, modulated output, waveguide carbon dioxide laser for laser radar (an essential element of future 3 dimensional automatic target classification technology) was demonstrated. The first integrated optic spectrum analyzer chip was fabricated. Integrated optics offer advantages in size, weight and cost in electronic warfare warning receivers. The high power 0.53 micrometer solid state laser technology transitioned to PE 63743F, Electro-optical Countermeasures. Key accomplishments in the Radar Technology thrust include the following. Significant advances in gallium arsenide solid-state microwave devices were achieved. These solid-state power sources will greatly improve the reliability of radar systems while significantly reducing size and weight. This opens up new opportunities in radar guided missile applications as well as future aircraft radar systems. Advances in solid-state, silicon Impact Avalanche Transit Time diodes and gyro-Travelling Wave Tubes were achieved. These will provide power sources for future radar, communications and countermeasures systems in the near-millimeter and millimeter wave frequency spectrum. This technology will be transitioned to PE 63431F for use in space communications in FY 1981. The first prototype solid-state phased array radar module was completed and integrated into a final module case. This is the first step toward an all solid-state phased array antenna which offers graceful degradation and 2,000 hour mean-time-between-failure rates. Some accomplishments in the Communications, Navigation, Identification Avionics thrust include the following. A wideband spread spectrum modulator-demodulator providing a significant degree of jam-resistant signal processing for compressed imagery transmission was developed. Such jam-resistance is becoming essential for successful reconnaissance and remotely piloted vehicle missions where information is telemetered back to ground stations. The feasibility of fabricating inertial gyro parts out of molded plastic to reduce the cost of missile-grade instruments was demonstrated. Work on nuclear magnetic resonance gyros showed that more basic research is needed before such a device is feasible. Electronic Warfare Systems Technology accomplishments include the following. A key to successful electronic warfare is obtaining detailed technical information on enemy equipment. Countermeasures are then designed to exploit weaknesses. This past year we achieved the ability to

This capability will be very useful in exploiting captured foreign materials.

taken with the development of

An important step in reducing aircraft radar cross-section was

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED, #521)

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

Accomplishments in the Support Software Technology thrust include the completion of a J-73 compiler with MIL-STD-1750 code generator for both a DEC-10 and an IBM computer. The DEC-10 version of the compiler was put in the Federal Software Exchange making it available to industry. MIL-STD-1750 is a standard computer instruction set which allows software coded with these instructions to be used on a wide variety of computers without change. This can greatly decrease software development costs by allowing broad use of previously coded programs. The software cost analysis expertise was put to use in an in-house analysis of the software cost for the North American Air Defense Space Computation Center. Some of the achievements in the System Integration, Analysis & Software Technology thrust are as follows. The Integrated Head-Up Display was completed with the delivery of a complete brassboard head-up display built to the approximate specifications of an F-16 head-up display. This program demonstrated the integration of diffraction optics with a liquid crystal matrix display as the image source, and has established the technical foundation for development of improved head-up displays which can provide an increase in reliability by a factor of four or five. Cost of ownership studies indicate that an improvement of this order would result in a savings of \$5 million per year when applied to a fleet of 500 aircraft. Tests of the Multiple Reference Gunnery System on an F-15 demonstrated a 200 percent improvement over the operational sight in forward hemisphere attacks.

2. FY 1981 Program: Microelectronics Technology highlights include the following. Current bubble memories cannot operate at the high temperatures required for many military applications. A new tri-Service effort will develop extended temperature range magnetic bubble memories. A nonvolatile semiconductor memory effort will develop high performance random access memories and electrically alterable read only memories required by high speed radar processors and communications systems. The gallium arsenide effort continues work on high circuit density electron beam fabrication technology and subnanosecond (below a billionth of a second) access random access memories and read only memories. A new gallium arsenide program will address the broad areas of an on-chip and off-chip interconnect technology plus gigabit logic circuit (process signals at a billion bits per second) packaging and testing requirements. These are steps needed to ready the technology for use in radar and electronic countermeasures systems which need speeds beyond those achievable with silicon technology. Electro-optical Technology thrust highlights are as follows. Phase II of the Forward Looking Active Classification Technology effort will demonstrate (with flight tests) 3 dimensional sensor technology in the forward looking mode used in real-time reconnaissance and strike applications. Phase I of the Combined Sensor for Target Acquisition, Recognition and Strike program begins. This phase provides preliminary specifications for a unified sensor using active/passive infrared images and millimeter wave radar which together have a synergistic benefit for automatic target classification. The Electro-optical/Millimeter Wave sensor concept has potential payoff for increased detection/recognition range, weather/dust/smoke penetration, enhanced target classification and precision weapon delivery.

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

A new effort will begin to develop an advanced, pulsed, solid-state laser with tunable output in the 1.5 to 2.0 micrometer region that can be Raman frequency shifted over the entire 2.0 to 5.0 micrometer region. Development of an integrated optic bistable device for special function high speed logic in electronic warfare applications will be initiated. Important work in the Radar Technology thrust includes the following efforts. Two new efforts, Automatic Synthetic Aperture Radar Target Classification, and Fixed Target Data Gathering will get underway. These projects lay the foundation for using high resolution synthetic aperture radar imagery to greatly improve the range and accuracy of air-to-ground target detection and identification. Millimeter wave power source technology will be expanded with a new effort to develop gallium arsenide impact avalanche transit time diodes of 40 to 100 gigahertz. Applications are in missile terminal guidance, countermeasures, and communications. The design, development and test of 100 X-band solid-state transmit/receive modules for phased array applications will be completed. This effort will demonstrate module producibility (important because aircraft radars will need 2,000 modules) and provide good reliability data. Begin flight tests on Tactical Bistatic Radar Demonstration effort to demonstrate feasibility of bistatic radar concept. This is a potential breakthrough in radar technology allowing a satellite or standoff aircraft to illuminate targets while strike aircraft operate in a stealthy mode. Key efforts in the Communications, Navigation, Identification Technology thrust include the following. A new effort will focus on critical components for frequency-hopping of wideband sensor video signals over a 2 to 4 gigahertz bandwidth. This would permit a covert data link, greatly reducing the vulnerability of reconnaissance platforms and ensuring data reception in the presence of jamming. Development will start on a strapped-down accelerometer with high accuracy performance in cruise missile and reentry vehicle environments. Work essential to the multi-function, Multiband Airborne Radio System continues. This includes work on a transversal filter/correlator using gallium arsenide charge coupled devices to adaptively detect and process spread spectrum signals. The Multi-function, Multiband Airborne Radio System is an integrated radio system design which includes modular building blocks, maximum commonality of modules, and configurability to permit tailoring of hardware solutions to individual aircraft mission combinations without proliferating a large number of one-of-a-kind radios throughout the operational inventory. Electronic Warfare Technology highlights are as follows. Development of discrimination and processing techniques for infrared threat warning receivers employing staring mosaic focal planes will be initiated. This improved sensor will give improved threat warning to a pilot when surface-to-air or air-to-air missiles have been fired against the aircraft. An effort will design, fabricate and evaluate

An effort

will be initiated to develop

effort will be aimed at

high temperature non-specular radar absorbing materials to reduce the enemy's ability to detect our aircraft. The goal is to develop a material which will reduce

Today's performance has

The

Continue development of

to detect our aircraft. The

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences, #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

An effort initiated in FY 1980 to define electronic countermeasures techniques against the advanced Soviet Union Airborne Warning and Control System, including both radar and associated data links, will be completed. Highlights in the Software Support Technology thrust include a new effort to develop integrated testing and maintenance methodologies compatible with digital avionic system architectures. This effort is designed to reduce the excessive time and cost of testing and maintaining avionic equipment. The development of an Integrated Support Software System to provide a coordinated environment for avionic software will begin. Support of the Advanced Avionic Computer Architecture effort (High Level Language Machine) will focus on the development of a JOVIAL J73 preprocessor to perform the traditional compiler function. The goal is to achieve a more direct relationship between source code and the computer machine language to reduce the cost and complexity of the J73 preprocessor and improve its efficiency. System Integration, Analysis and Software Technology thrust contains the following important efforts. A conceptual design and evaluation of distributed processing, multiple-multiplex bus architectures that integrate traditional avionic systems with flight critical functions will begin. The output of the study will be an assessment of a totally digital aircraft, development of network processors, and an assessment of distributed executive control functions. The development of fire control algorithms and mechanizations on the Avionics Systems Analysis and Integration Laboratory will begin to integrate emerging technologies supporting the multiple target air-to-air mission. Development of an advanced avionics computer architecture will continue the objective of developing an avionics computer family architecture which more directly supports high order language programming and meets the increased general and special processing requirements of future avionics processing suites. The advanced integrated fire and flight control design assessment will be completed. This important technology, which couples fire and flight control systems, significantly increases the lethality and survivability of strike aircraft in air-to-ground and air-to-air missions.

3. FY 1982 Planned Program: The program has increased \$5.8 million in then year dollars since the FY 1981 Descriptive Summary was submitted. Approximately \$1.9 million of this increase will fund the 1 October 1980 Civilian salaries increase. The remainder has been allocated to the radar technology, electronic warfare, and electro-optical technology thrusts to pursue technological opportunities in these areas on a more timely basis. Specific efforts in these thrusts are discussed below. Highlights from the Microelectronics Technology thrust include the following. The major thrust will be the development of a full spectrum gallium arsenide technology with subnanosecond delay times to meet advanced radar and electronic countermeasures needs. The technology development includes logic circuits, memories and feasibility demonstration subsystems. Surface passivation of gallium arsenide and enhancement-mode junction field effect transistor, medium scale integration development receive emphasis to make the circuits reliable and reduce power consumption. Bubble and nonvolatile memory efforts continue with a new program to develop logic enhanced memory systems, Computer Aided Design efforts will focus on developing techniques to assure testability and develop high speed interconnect methods which are critical links in the usefulness of high-speed submicrometer feature size integrated circuits. The Electro-Optical Technology thrust is being increased (\$1 million). Phase II of the Carbon Dioxide Laser Sensor Technology Development gets underway and will include sensor fabrication, laboratory checkout, and initial field tests. This sensor will be capable of achieving terrain following/terrain avoidance/obstacle avoidance, target acquisition and tracking and weapon guidance. It will be compatible with three dimensional automatic target classification concepts. A new effort, Laser Target Discrimination Techniques, will be initiated to further the value of three dimensional

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classification approach by examining the potential of discriminants such as doppler vibration detection, exhaust gas discrimination and surface material discrimination. The Multiple Function Forward Looking Infrared Subsystem effort will develop a single forward looking infrared sensor capable of use for high resolution target acquisition, manual pilotage, automatic terrain following and terrain avoidance, and obstacle avoidance. Such a device, if feasible, would permit aircraft to ingress and egress the battlefield without turning on their radar and revealing their position. Rapid and accurate detection of targets is provided by work on the 3 dimensional classification technology. In this area, the Forward Looking Active Classification Technology program will complete flight tests. Linear wavelength conversion methods in solid-state lasers will be initiated to reduce size, increase reliability, and extend life of wavelength agile, near infrared lasers. This work continues the drive toward wavelength agile lasers as a countermeasure to Soviet electro-optical tracking systems. An optimized high bandwidth, thermo-electric cooled mercury-cadmium-telluride detector for laser radar will be delivered and development of an array for coherent detection initiated. The tunable 1.5 to 2.0 micrometer solid-state laser will be demonstrated and development of frequency shifting methods for the 2 to 5 micrometer region started. Development of the brassboard, compact, 1.8 to 5.0 micrometer chemical laser will be completed. An additional \$2.285 million has been added to the Radar Technology thrust in FY 1982. Key efforts in this thrust included the following. An effort to design and fabricate an X-band solid-state phased array transmitter using modules developed in FY 1980 and FY 1981 will begin. This work will lay the foundation for a multifunction, agile beam, solid-state modular radar with greater mission capabilities, higher reliability (2000 hours versus today's 40 hour mean-time-between failure), and smaller size than traveling wave tube radar systems. Critical technologies development on the Covert, In-weather Recce/Strike effort will begin using the results of the previous year's architecture definition effort and the flight test results of the Tactical Bistatic Radar Demonstration project (completed this year). This effort is considered a potential breakthrough in radar technology in that it would allow a satellite or standoff aircraft to illuminate targets while strike aircraft operate in a stealthy (receive only) mode. System concept definition of an advanced electronic counter-countermeasure technique using spread spectrum concepts will begin. This effort will develop the technology radars will need to operate in the severe electronic counter-countermeasures environment of the 1990s. Development of medium and high range resolution moving target classification techniques for the automatic Synthetic Aperture Radar Target Classification effort will start. Updating the airborne synthetic aperture radar testbed will continue. It provides the means of developing and flight testing critical subsystem radar technologies leading to high performance ground mapping operations in near real-time in a hostile environment. Highlights in the Communications, Navigation, Identification Technology thrust include the following. In the data link technology area, a new effort in 3 dimensional image compression will be started, investigating frame-to-frame processing to achieve an additional 10 decibel improvement over current state-of-the-art. The ultimate goal is semiautonomous operation of a reconnaissance (or remotely piloted vehicle) data link via a periodic rather than continuous transmission to decrease the enemy's opportunity to detect and locate the vehicle or jam the signal. Accelerometers have become the performance pacing items as ring laser and strapdown gyros have eliminated the gimballed inertial navigation systems. Therefore, work on a high accuracy accelerometer for advanced cruise missile applications will start. Begin development of an advanced Global Positioning

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Budget Activity: Technology Base, #1

Receiver (based on frequency domain techniques) which will not only be smaller and simpler, but will also function as a joint tactical information distribution system receiver. Complete high accuracy Ring Laser Gyro testing and transition the technology to advanced development in 63203F, Advanced Avionics for Aircraft. Complete the molded inertial manufacturing development. Complete the agile transversal filter/correlator and radio frequency large scale integration circuit work for the Multifunction, Multiband Airborne Radio System effort. Work in the Electronic Warfare Technology thrust is also receiving additional emphasis in FY 1982 and includes the following key efforts. Initiate an effort to investigate integration of

The inherent

Efforts will be started to investigate concepts for -

Continue the effort on a breadboard transmitter for a counter command, control, and communications application. Test and evaluation of planned efforts in the Software Support Technology thrust focus on the continuation of new initiatives begun in FY 1981. The development of software for the High Level Language Machine will continue in an effort to lower the cost of software development with the use of a standard, high order language. Work on the Integrated Support Software System will also continue and make available an operational software configuration management system for the Avionics System Analysis and Integration Laboratory. The support environment for the Department of Defense High Order Language, Ada, will be specified and software development initiated. Highlights of efforts in the System Integration, Analysis, and Software Technology thrust include the following. A new effort to develop a fiber optic wavelength multiplexing system will begin. Such a system will be the future replacement for the present wire multiplex buses, using wavelength division multiplexing to allow far greater amounts of information (over 100 million bits per second) to be transmitted over the internal communication system. This high data rate is required for the highly integrated avionics suite in the digital aircraft of the future. A defensive missile launch envelope algorithm will be developed to support air-to-air fire control battle planning. Such algorithms will play an important role in the effective use of beyond visual range, air-to-air missiles. New approaches using all-weather sensors in conjunction with pattern matching techniques and pattern recognition will be explored to see how they might improve low altitude guidance. Low altitude missions are receiving increasing emphasis due to increased lethality of enemy defenses. With this same objective in mind, the Electronic Terrain Map System brassboard will be completed and incorporated into the Avionics System Analysis and Integration Laboratory. This is a system which uses digitally sorted terrain information to generate and display terrain and threat information to aid a pilot flying at very low altitudes. Effort continues on the development of the multiple bus avionic system architecture which will assess and exploit the avionics implications of a totally digital aircraft.

4. FY 1983 Planned Program. Highlights from the Microelectronics Technology thrust include the following. If previous work on Josephson Junction technology is successful, an effort will be initiated to develop an ultra-high speed Josephson Junction signal processor for applications in radar, electro-optical, and radio frequency signal processing. Gallium arsenide technology will advance to the demonstration phase with the initiation of analog to digital converters and fast Fourier transform chip development programs. These efforts are aimed at signal processing speeds beyond attainable with very high speed integrated circuits. The nonvolatile memory technology will demonstrate a

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high speed 4,000 bit random access memory chip and 16,000 bit read only memory chips, each expandable by a factor of 4 or more in outyear efforts. An effort to develop fiber optics transmitter/receiver circuits will enhance the Air Force's capability in optical data transfer on the aircraft and complement the fiber optic data bus efforts. Work in the Electro-Optical Technology thrust increases as some of the efforts from previous years expand. A new effort entitled Forward Looking Active Classifier Technology Processor Requirements and Design Study will be initiated. This effort will refine the previously developed 3 dimensional algorithms, determine real-time processor requirements and generate preliminary processor design information. These specifications will be needed by developers wanting to implement the 3 dimensional technology on upcoming weapon systems. Phase II of the Carbon Dioxide Laser Sensor Technology Development effort will be completed. Phase III will be initiated to modify the rooftop sensor to perform under flight conditions for final technology demonstration. Sensor and processor fabrication on the Combined Sensor for Target Acquisition and Recognition for Strike project will begin with completion scheduled in FY 1984. Methods to rapidly switch wavelengths and modulation formats in lasers will be initiated to overcome potential enemy countermeasures. Pulsed solid-state, 2 to 5 micrometer laser continues under development. The basic building block for special function, high-speed optical processing, the bistable optical device, is demonstrated. This high risk technology offers potential switching speeds in the subpicosecond region which would significantly increase the Air Force's signal processing capabilities. Significant funding increases in the Radar Technology thrust are planned as the efforts begun in earlier years reach the hardware fabrication and flight test stage. Portions of the critical Covert, In-weather, Recce/Strike technologies begin flight tests to demonstrate the ultra-high resolution synthetic aperture radar and signal data focus techniques. Initiate the advanced synthetic aperture radar target and the high range resolution moving target classification developments which are needed for automatic target classification. Each of these efforts will use the synthetic aperture radar technology testbed to demonstrate critical technology developments. Exploit advances in power transistor and diode technology and solid-state and thermionic millimeter wave devices for use in missile guidance radars as well as countermeasures and communications. Initiate advanced antenna nulling technology for improved electronic counter-countermeasures. Key areas in Communications, Navigation, Identification Technology thrust include the following. Development of adaptive signal processing algorithms for complex spread spectrum and narrow-band waveforms will be initiated. This effort will exploit expected advances in the agile bandpass/transversal filter completed earlier as well as integrating interference canceling techniques developed under adaptive interference project. Such algorithms are needed to support the hardware efforts in assuring secure, highly jam-resistant communications in a hostile electromagnetic environment. A new effort in flexible encoding/decoding techniques will be initiated which will apply expected advances in high-speed signal processing emerging from the Very High Speed Integrated Circuits program. Initiate development of a ring laser gyro using fiber optic technology to decrease cost and size while improving potential accuracy. Continue high accuracy accelerometer brassboard development. Continue advanced signal processing technologies for next generation Global Positioning System receivers. Highlights of the Electronic Warfare Technology thrust include the following. Technology efforts in

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

development of an improved missile warning receiver using advanced focal plane processing techniques will be started. This receiver will both improve the probability of detection of a missile launch and greatly reduce the number of false launch indications. A field evaluation will be performed to examine the 'derived in a previous program, determine those having the highest probability of success and make recommendations for their use in future countermeasures systems. A major effort will be initiated to design and fabricate a breadboard model of a'

Work in the Software Support Technology includes the following. During this time period the demonstration model of the High Level Language Machine will be developed and tested in the Avionics System Analysis and Integration Laboratory. This will include the demonstration of potential payoffs in lower software development costs using a standard, high order language, on avionics applications. Key efforts in the System Integration, Analysis and Software Technology thrust include the start of development work on system specifications and subsystem parameters for a totally integrated, advanced avionic network with emphasis on high battle-damage survivability. This effort builds on the multiple-multiplex data bus architecture which allows automatic reconfiguration of the avionics suite to work around failed elements. Application of computer speech recognition techniques to automation of cockpit functions will begin. A demonstration model of the High Level Language Machine will be evaluated in the Avionics System Analysis and Integration Laboratory. It will show the feasibility of an avionics computer family architecture that supports high order language programming and satisfies real-time processing requirements of avionics subsystems.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06CQ

Program Element: 62204F

DoD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Air Force Avionics Laboratory Operations

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Air Force Avionics Laboratory, Wright-Patterson Air Force Base OH. The Air Force Avionics Laboratory is responsible for research, exploratory and advanced development programs concerned with navigation and guidance, weapon delivery and fire control, reconnaissance and aerospace surveillance, aerospaceborne communications, electronic countermeasures, avionic systems architecture and integration, and electronic and electro-optical device technology. The laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. This project provides for the pay and related costs of civilian scientists, engineers, and support personnel; travel; transportation of equipment; rental equipment; communications and utilities costs; procurement of supplies and equipment; duplication and reproduction services; and contractor support services for maintenance and modification of facilities.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element as well as other projects and programs managed by the Air Force Avionics Laboratory including: Advanced Avionics for Aircraft, 63203F; Reconnaissance Sensors/Processing Technology, 63208F; Very High Speed Integrated Circuits, 63452F; Electronic Warfare Technology, 63718F; Advanced Communications Technology, 63727F; Air-to-Air Identification of Non-Cooperative Targets, 63742F; Electro-Optical Warfare, 63743F; and Counter-Countermeasures Advanced Development, 63750F.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base OH, is responsible for the management of the projects under this program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: The accomplishments and plans for this support program are covered in the Descriptive Summary for the total program element.

1. (U) Program to Completion: This is a continuing program.

2. (U) Milestones: Not applicable.

3. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	20,798	23,285	25,446	25,852	Continuing	Not Applicable

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Project: #06CQ
 Program Element: 62204F
 DOD Mission Area: Electronics & Physical Sciences (ED), #521
 Title: Air Force Avionics Laboratory Operations
 Title: Aerospace Avionics
 Budget Activity: Technology Base, #1

4. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981 <u>Estimate</u>	FY 1982 <u>Estimate</u>	Additional to Completion	Total Estimated Costs Not Applicable
RDT&E	21,600	23,200	23,500	Continuing	

Changes are reflected in the FY 1981 and FY 1982 program due to the additive cost of the 1 Oct 1980 civilian pay raise and revised estimates of reimbursement for support provided to other programs and agencies.

Project: #2002

Program Element: 62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Microwave Technology

Title: Aerospace Avionics

Budget Activity: Technology Base; #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Microwave components are the heart of all radar, electronic countermeasures, and communications systems. When these components fail, aircraft and missile radars can't find targets, aircraft radars can't do terrain following and terrain avoidance, electronic countermeasures can't detect and jam threats, and communications systems break down. This project develops the technology to improve airborne microwave device and subassembly performance, improve their reliability, and decrease their costs. The scope of activity extends from critical microwave device development through selected equipment feasibility demonstrations of microwave sources, circuits, antennas, radomes, and sensor techniques. Some of the current needs being addressed follow. Solid state microwave power sources and detection devices with higher power output, lower noise, better efficiency, higher frequency of operation, and wider bandwidth are required for replacement of low and medium power microwave tubes in aircraft and missile radars, electronic countermeasures receivers and transmitter front ends, and aerospaceborne communications sets. High power microwave tubes need longer life, higher power, lower cost and wider bandwidth for electronic countermeasures and aircraft multifunction radar applications. All solid state phased arrays are being developed to completely replace tubes in aircraft multifunction radars, increasing radar performance and reliability. The millimeter technology base is being actively developed for missile terminal guidance, countermeasures and, spaceborne communications applications.

(U) RELATED ACTIVITIES: The Army, Navy, Defense Advanced Research Projects Agency, and National Aeronautics and Space Administration have exploratory development programs in microwave technology. These programs support their specific requirements and complement the work in this project. The DOD Advisory Group on Electron Devices coordinates each effort in this project. The Microwave Working Group of the Advisory Group on Electron Devices met 7 times in FY 1980 to consider in detail the efforts of the above agencies and the Air Force in microwave technology. Efforts were examined for technical merit and to prevent duplication of effort. In addition, symposia and informal contacts among government workers within these agencies further insured full coordination of the efforts. Related activities include: Advanced Avionics for Aircraft, 63203F; Electronic Warfare Technology, 63718F; Advanced Attack Weapons, 63609F; and Advanced Space Communications Technology, 63431F.

(U) WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for the management of this project. In-house facilities available to support this project include a near field antenna and radome measurement facility and a microwave technology laboratory for device, circuit, and microwave subassembly design, fabrication, test, and evaluation. The ten largest contractors in FY 1980 were: Hughes Aircraft Company, Culver City CA; Texas Instruments, Inc., Dallas TX; Motorola, Inc., Scottsdale AZ; Raytheon Company, Waltham MA; Northrop Corporation, Rolling Meadows IL; TRW, Inc., Redondo Beach CA; Georgia Institute of Technology Research Institute, Atlanta GA; General Dynamics Corp., San Diego CA; Georgia Institute of Technology, Atlanta GA; and University of Michigan, Ann Arbor MI. In addition, there were nine contractors located nationwide with thirteen contracts. In all, there were forty-nine contracts.

Project: #2002

Program Element: #62204

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Microwave Technology

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

1. (U) FY 1980 and Prior Accomplishments: Gallium arsenide solid state devices showed rapid advances. A power combiner using gallium arsenide diodes demonstrated 390 watts peak power and 100 watts average power at X-band. Such power combiners are small enough to be used in missile guidance heads, replacing expensive and bulky tubes. Diode power combining at chip level was demonstrated. This technique promises further size and cost reductions compared to resonant cavity combiners or tubes. Gallium arsenide microwave transistors also demonstrated improvements in power, bandwidth, noise level and efficiency. Transistors offer wider bandwidth and less complicated circuits for use in microwave amplifiers for radar and countermeasures applications. Silicon microwave diodes produced significant power at millimeter wave frequencies - 0.75 watt was demonstrated at 94 gigahertz. Missile terminal homing is the principal application. The first of ten prototype all solid state phased array modules was completed. After the first ten are evaluated one hundred modules will be built and evaluated to show producibility. The objective is a multifunction fighter radar transmitter/receiver which will improve the mean time between failures by a factor of at least 100 over tube based radar and have graceful degradation of performance. Tube technology also progressed this year. Design work was completed for a crossed field amplifier tube for multifunction radar application. This tube will compete with a traveling wave tube in development for the same application. Design of a flyable gyro-traveling wave tube was completed and fabrication work was begun. The goal is five thousand watts of power at 95 gigahertz for countermeasures applications. Tubes still are the only way to get large powers from single devices. They will be important in countermeasures applications well into the next century. Solid state phased arrays will gradually take over in air and spaceborne radars and communications applications.

2. (U) FY 1981 Program. A program to improve missile guidance traveling wave tube storage life begins. Since these tubes are both expensive and essential for missile effectiveness, this will significantly reduce missile life cycle costs and increase missile probability of hitting targets. New efforts begin in millimeter wave solid state diodes and diode power combiners. The principal applications will be missile terminal guidance and communications. Development of high gain, broad bandwidth microwave integrated circuit amplifiers begins for expendable jammer and phased array radar applications. The approach uses integrated circuit fabrication technology which has provided greatly increased reliability, and reduced costs in the computational arena to reduce microwave circuitry costs. New diode power combiner efforts will be at millimeter wave frequencies for satellite communications and missile terminal guidance applications. The effort to develop a solid state amplifier for the 2-10 gigahertz region (to replace low power tubes) will continue. Lower cost and higher reliability compared to tubes are the rationale. Development of a single bottle dual mode tube for the 2-8 gigahertz region will continue. Application is electronic countermeasures. The single tube would replace two or more tubes in a countermeasures system. The fabrication of 100 X-band all solid state phased array radar modules will be completed and their evaluation (for performance, reliability, and producibility) will begin. Optical feed techniques for phased arrays will also be evaluated. This method has a significant electronic counter-countermeasure potential. Circuit and chip configurations for power combining both microwave transistors and

Project: #2002

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Microwave Technology

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

diodes at X-band and Ku band will be demonstrated. Components will be demonstrated for signal reception and control at 94 gigahertz. The principal application is missile terminal guidance, but countermeasures applications are on the horizon.

3. (U) FY 1982 Planned Program: The largest new start will be design and fabrication of an X-band solid state phased array antenna. This will build on the experience gained in the evaluation of the 100 modules in FY 1981. The payoff is an all solid state fighter radar transmitter/receiver capable of air-to-air, air-to-ground, ground mapping, terrain following, and terrain avoidance modes with a mean time between failures of 2000 hours. Most of the additional funding (compared to last year's Descriptive Summary) will be used to accelerate this effort because of its high payoff. A new effort will start to develop 20-100 gigahertz receiver technology for countermeasures applications. New efforts in gallium arsenide power transistors will push for higher power, frequencies and efficiency. New work in small signal gallium arsenide transistors will extend their frequency range beyond 40 gigahertz. Small signal transistors are used in radar, countermeasures, and communications "front ends" (amplifiers immediately following the antenna). A new interaction circuit to lower the cost and increase the peak power of traveling wave tubes will be investigated. New cathode development for tubes will begin. High current density and reproducibility will be the objective. Millimeter wave countermeasures will be the principal application. Investigation of microwave and optical interactions will begin. The objective is to demonstrate cheaper and more effective methods for signal reception and control especially at millimeter wave frequencies. Work on magnetostatic wave components will continue. These components simplify microwave circuits by doing analog signal processing at X-band frequencies. Development of a broad bandwidth high gain microwave amplifier on a chip will continue. High power gallium arsenide diodes for communications and countermeasures applications will be demonstrated at 10 and 20 gigahertz. A single bottle dual mode (continuous wave and pulsed) traveling wave tube will be demonstrated for countermeasures application. This one tube will cover the band from 2 to 8 gigahertz, have a continuous wave power of 300 watts and a pulse power of at least 2000 watts. Two traveling wave tube designs for millimeter wave frequencies above 60 gigahertz and below 60 gigahertz will be demonstrated for countermeasures applications. Investigations of fast wave electron interactions above 90 gigahertz will produce high power millimeter wave tubes which are more practical than the gyrotron for airborne systems. Countermeasures will be the primary application.

4. (U) FY 1983 Planned Program. Fabrication of 100 solid state phased array modules will begin for airborne satellite communications terminals. Low cost, high reliability, and good counter-countermeasures potential are the driving requirements. These 100 modules will answer questions about producibility and cost. New work in solid state diodes will push for linear operation in order to use diodes more effectively in amplifier applications. The fabrication of the all solid state radar phased array will continue. The drive to increase diode and transistor performance, reliability, and cost will continue. Applications are tube replacement in radar, countermeasures, and communications.

Project: #2002

Program Element: #62204F

DOD Mission Area: Electronics & Physical Sciences (ED), #521

Title: Microwave Technology

Title: Aerospace Avionics

Budget Activity: Technology Base, #1

Microwave 20 gigahertz diodes able to meet the stringent lifetime requirements for satellite communications will be demonstrated. Gallium arsenide diodes for the 40-100 gigahertz regime will be demonstrated. Primary applications are for missile seekers. Millimeter wave tubes for countermeasures applications will be completed and evaluated. Work will start on a high power millimeter fast wave tube using a less bulky technology than the gyrotron. Countermeasures is the application. A broad bandwidth solid state 20 gigahertz amplifier for satellite communications will be completed and transitioned to Space Division. Development of passive components for millimeter wave frequencies above 100 gigahertz will be completed. Measurement standards for 94 gigahertz will be completed at National Bureau of Standards with funding from this project. Such standards will be necessary for measuring component performance at this frequency. This is important primarily for missile seeker applications.

5. (U) Program to Completion. This is a continuing program.

6. (U) Milestones. Not applicable.

7. (U) Resources. (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E (3600)	5,978	5,700	6,700	8,300	Continuing	Not Applicable
RDT&E	6,000	5,800	5,900		Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

Additional dollars have been allocated to this project in fiscal year 1982 to pursue the X-band solid state phased array antenna effort on a technology paced schedule due to its potentially high payoff.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62205F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) (\$ in Thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
		10,740	12,500	16,200	18,500	Continuing	Not Applicable
06ST	Laboratory Support	4,341	4,952	5,341	5,453		
1121	Technical Training Development	987	848	1,050	1,350		
1123	Flying Training Development	798	800	1,050	1,400		
1192	Advanced Simulator for Pilot Training	3,100	3,700	4,550	4,907		
1710	Training and Personnel Factors in System Design, Maintenance, and Operations						
6114	Simulation Techniques for Air Force Training	676	1,500	3,059	3,690		
		838	700	1,150	1,700		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will improve operational readiness through more effective and efficient training and increased weapon system supportability. It consists of efforts grouped under the following three categories: HUMAN FACTORS, EDUCATION AND TRAINING, and TRAINING DEVICES AND SIMULATION. Significant opportunities exist for improving flying and technical training effectiveness with flight and maintenance simulators. A major thrust is under-way using the Advanced Simulator for Pilot Training, a full-visual Research and Development flight simulator, to develop innovative methods for flight simulator training of tactics used in air-to-air and air-to-ground warfare. Improved flight simulator hardware is being developed to support these new training methods. Maintenance training will be made more cost effective by development of maintenance simulators. These devices permit the simulation of malfunctions and they allow hands-on maintenance training and trouble-shooting to take place without tying up or damaging very expensive real hardware. Logistics support of weapon systems will be improved by determining the interactions between the human factors elements of logistics and the associated characteristics of weapon systems. Cause and effect relationships in life-cycle costs will be determined and technology developed to assure effective logistics support for maintenance in a combat situation. The support of the Air Force Human Resources Laboratory, Brooks Air Force Base TX, is partially funded by this program element. The Research and Development efforts are coupled directly with the major command training programs, with programs conducted by the Aeronautical Systems Division and with Army and Navy programs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program includes the demonstration of a helmet-mounted display and improved moving target capability in the Advanced Simulator for Pilot Training at Williams AFB AZ to improve combat readiness training in the area of multi-target air combat maneuvering, new simulator image generation capability to provide meaningful terrain texture, and improvement of visual scene detail required for air-to-ground and air-to-air simulation to increase combat readiness.

Program Element: #62205F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology

Budget Activity: Technology Base, #1

Successful results of these projects will be transferred to advanced development simulation programs. Increased Air Force emphasis on improving the interactions between manpower and logistics needs supports the growth in logistic-related training and personnel efforts. Specific efforts include analysis of factors to improve the wartime readiness of maintenance organizations; handbooks to aid in the design and procurement of maintenance simulators; and development and evaluation of a computer terminal system to increase accuracy, speed, and security of tests administered during technical training.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
		Estimate	Estimate	Estimate	to Completion	Estimated
						Costs
RDT&E	10,500	13,000	14,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #62205F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program addresses two of the three principal thrusts of the Air Force Human Resources Laboratory: (1) Air Combat Tactics and Training and (2) Weapon System Logistics, Maintenance, and Technical Training. These thrusts are included in the major categories of HUMAN FACTORS, EDUCATION AND TRAINING, and TRAINING DEVICES AND SIMULATION. The first thrust will help provide, through the use of flight simulators, trained aircrews capable of operating aerospace vehicles effectively under both peacetime training conditions and wartime combat conditions. The greatest benefit from this thrust will be an expanded combat training capability in which aircrews will be able to rehearse full missions in the simulator under realistic threat and flight conditions that cannot or should not be duplicated with actual aircraft. The second thrust will help assure support of Air Force operations by developing the technology to (1) consider the interactions of the design and use of weapon systems with the logistics and human resources required to support those systems during early design stages, (2) plan and manage personnel-related aspects of logistics support for wartime maintenance, and (3) improve the performance of maintenance personnel and organizations. Payoffs from this thrust include (1) decreased life-cycle costs due to more effective planning and management of the human resources requirements of weapon systems, (2) increased probability of mission success due to improved logistics support, and (3) enhanced on-the-job performance of Air Force technicians due to better training on maintenance simulators. This program element, in addition to being the primary technical base exploratory effort in Training and Simulation Technology, provides technical support to other Air Force and Department of Defense agency programs and receives partial reimbursements for the services provided. In the case of basic research accomplished by the Laboratory, full reimbursement is provided by Program Element 61102F, Defense Research Sciences. The project funding reflects the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: The majority of work is directly in support of requirements identified by major commands, Air Staff agencies, and separate operating agencies. Related efforts of the military services are identified in the Training and Personnel Technology Area Description. Related program elements are: 61102F, Defense Research Sciences; 63227F, Advanced Simulator Technology; 63751F, Innovations in Education and Training; 64227F, Flight Simulator Development; 62757N, Human Factors and Simulation Technology; 62722A, Manpower, Personnel, and Training; and 62727A, Non-System Training Device Technology. The Laboratory has Memoranda of Agreement with the Army Program Manager for Training Devices for computer image generation projector technology development, and with the F-16 System Program Office for maintenance aids development and resource planning and allocation. Research agreements with Air Training Command, Tactical Air Command, Air Force Logistics Command, Strategic Air Command, Simulator System Program Office, Naval Training Equipment Center, and National Aeronautics and Space Administration clearly describe work to be accomplished, list necessary support to be provided by the user of the technology, and insure adequate coordination of efforts. The Navy has a liaison office with the Laboratory's Operations Training Division at Williams Air Force Base AZ. In addition, personal contacts, meetings, and formal contacts such as the DOD Technical Advisory Groups provide coordination between specific focal points for research and development efforts.

(U) WORK PERFORMED BY: The program is managed by the Air Force Human Resources Laboratory, Brooks Air Force Base TX. Two Laboratory divisions support this program element: Logistics and Technical Training, Wright-Patterson Air Force Base OH, and Operations Training, Williams Air Force Base AZ. The Logistics and Technical Training Division is collocated with the Air Force Logistics Command, the Simulator Systems Program Office, and numerous other Air Force Laboratories and System Program offices at Wright-Patterson Air Force Base OH. The Technical Training Branch of this division is collocated with the Air Training Command Technical School at Lowry Air Force Base CO. The Operations Training Division is collocated with Air Training Command pilot training operations at Williams Air Force Base AZ. The major contract efforts in FY 1980 were

Program Element: #62205F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Training and Simulation Technology
Budget Activity: Technology Base, 1

conducted by the following companies: Lear Siegler, Oklahoma City OK; Boeing, Seattle WA; McDonnell-Douglas, St. Louis MO; Systems Engineering Lab, Ft. Lauderdale FL; General Electric, Daytona Beach FL; Singer, Binghamton NY; University of Denver, Denver CO; Clemson University, Clemson SC; General Dynamics, Fort Worth TX; Grumman, Bethpage NY; Honeywell, Minneapolis MN; and University of Dayton, Dayton OH. The total contract program (\$6.399 million) included a total of 25 contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In the area of EDUCATION AND TRAINING: Completed a preliminary on-the-job training capacity study to specify, in objectively measurable terms, the factors which impact a military unit's capacity to conduct on-the-job training without mission requirements being impaired. Developed for Strategic Air Command measurement and scoring methods for evaluation of the performance of B-52 electronics warfare officers. Provided to Aeronautical Systems Division a report on which tasks must be accurately simulated in the B-52 Companion Trainer Aircraft if effective training is to take place. In the area of HUMAN FACTORS: Developed computer programs to predict the interactions among maintenance man-power, spare parts and support equipment. The programs can forecast the impact of various mixes of these factors on aircraft readiness to fly both peacetime and wartime missions. Transitioned technology for improved Technical Orders to Air Force Logistics Command use with the possibility of reducing spare parts consumption by up to 10%. In the area of SIMULATION AND TRAINING DEVICES: Demonstrated the technology required to link two geographically dispersed flight simulators (the Advanced Simulator for Pilot Training, Williams Air Force Base AZ, and the Simulator for Air-to-Air Combat, Luke Air Force Base AZ) and "fly" the simulators against each other in air-to-air combat. This link is the first step in simulation of a complete combat scenario using several simulators.

2. (U) FY 1981 Program: In the area of EDUCATION AND TRAINING: Determine the best methods for obtaining accurate performance data on Tactical Air Command pilots flying Air Combat Maneuvering Range engagements and thus improve training effectiveness. Develop specifications for an ultrasonic non-destructive inspection trainer which will improve the reliability of ultrasonic inspection within aircraft maintenance programs. In the area of HUMAN FACTORS: Provide weapon system designers more accurate means of predicting the maintenance demand rates of aircraft subsystems than the commonly used flying hours/sortie rate indicators. Determine the factors that impact the performance of individuals and organizations who perform aircraft and missile maintenance and thus identify areas where application of existing technology will provide the greatest maintenance improvements. In the area of SIMULATION AND TRAINING DEVICES: Develop advanced computer image generation techniques utilizing non-linear methods for terrain representation to provide a more realistic visual scene in flight simulators and thus improve training effectiveness and aircrew proficiency.

3. (U) FY 1982 Planned Program: In the area of EDUCATION AND TRAINING: Identify the instructor problem areas and instructor roles required in a computer-managed instructional environment. These instructors are being required to perform a wide variety of instructional tasks that are not required in a conventional, group-paced classroom. This effort will increase instructor skills in the non-conventional environment with a matching increase in training effectiveness. Develop an information system to help managers of Air Force training to determine whether specific training should be accomplished in technical school or through on-the-job training. Determine force and disturbance cues necessary to provide effective flight simulator training under conditions of instability or turbulence caused by clear air turbulence, wind shear, system failure and damage. Evaluate the potential of a helmet-mounted visual display to adequately portray high-resolution targets within a low-resolution background. In the area of HUMAN FACTORS: Develop the capability to more accurately analyze, evaluate, and predict the war readiness of aircraft maintenance organizations and thus improve the ability to specify the

Program Element: #62205F

DOD Mission Area: Environmental and Life Sciences (ED) # 522

Title: Training and Simulation Technology

Budget Activity: Technology Base, #1

personnel, training, management policies and logistics support needed to achieve various degrees of war readiness. Determine the technology required to measure and improve Command, Control and Communication team performance and thus develop team training procedures and improve system hardware design. Develop improved programs to clarify the interactions of maintenance planning, support and test equipment, supply support, transportation and handling, technical data, facilities, personnel and training for use during the acquisition of new weapon systems in order to decrease the life cycle cost of a new system through improved prediction of logistics requirements. In the area of SIMULATION AND TRAINING DEVICES: Develop visual displays for simulation systems that offer reduced size and weight for the large visual areas required in future flight simulators. Determine the most promising hardware technology for development of portable combat readiness training devices which can be taken into the field for training and mission rehearsal using the latest intelligence information available just prior to actual mission execution. Increase in funding from the FY 1981 Descriptive Summary covers the 1 October 1980 civilian pay raise, needed improvements to the Advanced Simulator for Pilot Training at Williams Air Force Base AZ, and the Laboratory research and development response to increased Air Force emphasis on improving the interactions between manpower, training, and logistics requirements.

4. (U) FY 1983 Planned Program: Work to be initiated in FY 1983 includes: Improve aircrew training by increasing realism of simulated advanced radar system displays, such as synthetic aperture radar, through improved computer image generation criteria. Enhance pilots' capabilities during hostile engagements by defining a program for specialized training in tactical decision making. Reduce system life cycle costs by coordinating the products of recent efforts to systematically consider human resources/logistics factors throughout the process of modifying or acquiring weapon systems.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #06ST

Program Element: #62205F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Laboratory Support

Title: Training and Simulation Technology

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The project provides for operation of the Air Force Human Resources Laboratory, Brooks Air Force Base TX, including pay and related costs of civilian scientists and support personnel, travel, transportation, rent, communications, utilities costs, procurement of supplies and equipment, and contractor support services. The laboratory performs research and development in manpower and force management, weapon systems logistics, maintenance and technical training, and air combat tactics and training in support of the immediate or potential needs of Air Force operational systems.

(U) RELATED ACTIVITIES: Supports and complements all projects in this program element.

(U) WORK PERFORMED BY: The project is managed by the Air Force Human Resources Laboratory with headquarters at Brooks Air Force Base TX, and divisions at Williams Air Force Base AZ, Wright-Patterson Air Force Base OH and Lowry Air Force Base CO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Plans and accomplishments are discussed in the overall program element submission.

1. (U) FY 1980 and Prior Accomplishments: Not applicable.

2. (U) FY 1981 Program: Not applicable.

3. (U) FY 1982 Planned Program: Not applicable.

4. (U) FY 1983 Planned Program: Not applicable.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: Not applicable.

RDT&E

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	4,341	4,952	5,341	5,453	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E

4,584	4,900	5,000	Continuing	Not Applicable
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The FY 1982 increase is due to the 1 October 1980 civilian pay raise.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62302F

Title: Rocket Propulsion
Budget Activity: Technology Base #1

DOD Mission Area: Engineering Technology (ED), #523

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT		29,230	30,750 *	34,800	44,200	Continuing		
06CJ	Laboratory Operations	9,767	9,960 *	10,821	11,096			
3058	Space Propulsion Technology	4,979	6,000	7,000	10,500			
3059	Ballistic Missile Propulsion	4,943	4,700	5,000	6,100			
3148	Air Launched Missile Propulsion	7,175	7,100	8,000	11,000			
5720	Multiple Application Technology	2,366	2,990	3,979	5,504			

*Does not include Oct 1980 pay raise

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides new concepts and techniques in rocket propulsion technology to improve Air Force ballistic missiles, satellite propulsion, space launch systems, air launched strategic and tactical missiles. Proven technologies for solid propellant motors, liquid rocket engines, electrical thrusters and high payoff advanced propulsion concepts minimize the development risk of advanced Air Force missile systems. This program also provides the operational support and management of the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The FY 1981-1982 major technology areas include propulsion options for advanced ballistic missiles to improve payload capability (10-15% throwweight improvement) and enhanced missile penetration and survivability through flexible front end propulsion; higher performance satellite thruster technology to reduce propulsion system weight yielding a 15% satellite weight savings; propulsion options for space systems deployment to accommodate near term payload growth capability as well as low acceleration orbital transfer of large space structures; and performance options for air launched missiles which address the interplay between increased weapons stand-off, improved kill probabilities, and lower life cycle costs.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	28,600	32,800	36,500		Continuing		

(U) OTHER APPROPRIATION FUNDS:

Military Construction

FY 1980	FY 1981	FY 1982	FY 1983
0	0	0	4,200

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Rocket Propulsion

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: New concepts and techniques in rocket propulsion technology are pursued to improve ballistic missiles, satellite propulsion systems, and air launched strategic and tactical missiles. This includes efforts to develop higher performance propellants; stronger and lighter weight cases and nozzles; less erosive nozzle inserts; advanced thrust vector control and increased service life for solid propellant rockets; high performance and long life electric propulsion systems; post boost propulsion with increased payload capability; longer life liquid propellant satellite attitude control systems; improved performance space launch vehicle upper stages. This program element, in addition to being the primary technology base exploratory development effort in rocket propulsion, provides technical support to other Air Force and DOD agency programs and receives partial reimbursement for the services provided.

(U) RELATED ACTIVITIES: Technology base activities are related to National Aeronautics and Space Administration, Navy and Army programs. Coordination is accomplished through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee, and through working level meetings and inter-service committees. This program provides the technology base for PE 63302F, Advanced Missile Propulsion, PE 63401F, Space Vehicle Subsystems.

(U) WORK PERFORMED BY: Air Force management of this effort and a comprehensive in-house program is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. Eleven active test areas with 35 test positions include propellant formulation and small scale mixing capability, and sea level and simulated altitude test facilities to test new subscale to full scale components. The ten major contractors in FY 1980 were: Thiokol Chemical Corporation, Brigham City, UT and Huntsville, AL; United Technologies (Chemical Systems Division), Sunnyvale, CA; Hercules, Inc., Magna, UT; Aerojet Company, Sacramento, CA; Rockwell International, Canoga Park, CA; Atlantic Research Corporation, Alexandria, VA; McDonnell Douglas Corporation, Huntington Beach, CA; TRW, Inc., Redondo Beach, CA; Fairchild Industries, Farmingdale, NY; and Martin Marietta Corporation, Denver, CO. There are 20 additional contractors with 24% of the total contract value.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Propulsion technologies which have made possible the Minuteman, Missile-X, Inertial Upper Stage, and reduced smoke Sidewinder and Maverick weapons systems were developed under this program. A striking example is the accumulation of many small step improvements in ballistic missile propulsion technology beyond the Minuteman vintage which have led to the MX ICBM. This AFRL-developed technology provides MX more than 1700 pounds payload increase over Minuteman technology which translates into a savings of \$12 billion. This was accomplished with an investment of \$60 million over fiscal years 1974 to 1982. Other demonstrated technologies include qualification of "reduced smoke" propellants providing a 40% reduced visibility of missile exhaust for world-wide deployment in the Improved Sidewinder missile and demonstration of the technological readiness of "minimum smoke" propellant which further reduces to 10% the exhaust visibility. Identification of significant extensions of a rocket's operational capability which can be realized by the employment of a boost/lift trajectory; range of the lifting trajectory is roughly double the range of a semi-ballistic trajectory. Demonstration at a component level of the technology necessary for up to 20% improvement in payload capability for future low-earth-orbit-to-synchronous-orbit transfer vehicles.

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Rocket Propulsion
Budget Activity: Technology Base #1

2. (U) FY 1981 Program: In Space Systems propulsion, monopropellant heater technology will be demonstrated providing a 25% reduction in propellant weight for satellite station keeping. Development will begin of low thrust, long burn propulsion technology for large deployed satellite structures. In Ballistic Missile propulsion, high energy fluorinated propellants will transition to advanced technology demonstration. Technology efforts will be initiated for advanced ballistic missile booster and payload propulsion efforts for Medium Range Ballistic Missile application. Air Launched Missile propulsion efforts will emphasize propulsion energy management options (multi-pulse, high slew rate thrust vector control) to increase missile effectiveness; payoffs include shorter turn radii during maneuvering, increased range, higher average speed and less restriction on aircraft flight regime.
3. (U) FY 1982 Planned Program: In Space Propulsion technology, engine and tankage component efforts will begin toward the goal of demonstrating high performance integrated bipropellant propulsion in order to maintain satellite propulsion weight at less than 10 percent of total satellite weight for long duration missions. Energy management concepts will be explored for solid propellant space motors to improve mission flexibility while maintaining the simplicity and low cost of solid propulsion. The pulsed plasma electric thruster will transition to advanced technology demonstration. Efforts in support of the Space Defense program will continue toward providing cost effective, improved performance propulsion options for the miniature vehicle and its associated launch vehicles. In Ballistic Missile propulsion, emphasis will be on technology for increased reliability and survivability under projected deployment modes and improved performance. Solid propellant activities are directed toward the development of safe high performance propellants that have increased ruggedness and service life, and reduced cost. Efforts will begin on propulsion components for small theater ballistic missile application, adapting technology developed for larger motors. In Air Launched Missile propulsion, component technology efforts will start toward development of continuous throttling, high performance prepackaged liquid propulsion to provide a performance increase of up to fifteen percent over comparable solid rocket propulsion. Efforts in reduced signature will focus on reducing applications constraints associated with minimum smoke propellants by improving the ballistic tailorability and reducing hazards; a major candidate in these areas, Glycidyl Azide Polymer (GAP), will move to motor scale demonstration..
4. (4) FY 1983 Planned Program: In Ballistic Missile Propulsion, payload propulsion efforts will be initiated for advanced strategic missile front ends to enhance missile flexibility with improved post boost propulsion and increased re-entry vehicle footprint. In Space Systems Propulsion, engine component efforts will be initiated to address high thrust, high performance propulsion for Advanced Military Spaceflight Capability needs currently under definition by the Air Force. Air Launched Missile Propulsion efforts will move toward full-scale demonstration of minimum smoke motor technology (propellant, liner, ignitor).
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #06CJ

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Laboratory Operations

Title: Rocket Propulsion

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides funds for the support activities required to conduct exploratory and advanced development programs and to operate the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. This is one of five projects which make up the exploratory development program for Rocket Propulsion. The project provides technical support to the Space and Aeronautical Systems Divisions of the Air Force Systems Command. The project provides an in-house program covering the following areas: propulsion phenomenology investigations, new concepts feasibility, applications evaluations, and systems support. It provides for the pay and related costs of civilian scientists, engineers and supporting personnel, travel, transportation, rent, communications and utilities costs, procurement of supplies and equipment, and contractor support services.

(U) RELATED ACTIVITIES: This project supports all of the technical projects under this program element as well as all other projects and programs managed by Air Force Rocket Propulsion Laboratory. Projects under PE 61102F, Defense Research Sciences, PE 63302F, Advanced Missile Propulsion, other advanced development program elements, and major system support reimburse this project for all direct cost.

(U) WORK PERFORMED BY: The Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA is responsible for management of this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Plans and accomplishments are discussed in the descriptive summary for the overall program element and individual projects.

1. (U) Program to Completion: This is a continuing program.

2. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
	9.767	9,960*	10,821	11,096	Continuing		
	9,300	9,900	10,000		Continuing		

*Does not include Oct 1980 pay raise.
3. (U) Comparison with FY 1981 Budget Data:

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Project: #3058

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Space Systems Propulsion Technology

Title: Rocket Propulsion

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops rocket propulsion technology for application to future military satellites and space launch and orbital transfer vehicles. Existing propulsion systems are being improved by extending life and increasing performance. New propulsion system concepts are evaluated. Related rocket plume data for the development of sensors to detect and track enemy missiles and satellites is being developed. Plume contamination models are developed to control spacecraft contamination.

(U) RELATED ACTIVITIES: Activities in this project are closely coordinated with NASA and Navy programs through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee, and through working level meetings and inter-service committees. This program provides the technology base for PE 63302F, Advanced Missile Propulsion, and PE 63401F, Space Vehicle Subsystems.

(U) WORK PERFORMED BY: Air Force management of this effort and a comprehensive in-house program is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. The major contractors in FY 1980 were: Thiokol Chemical Corporation, Brigham City, UT and Elkton, MD; United Technologies (Chemical Systems Division), Sunnyvale, CA; Aerojet Company, Sacramento, CA; Rockwell International, Canoga Park, CA; Bell Aerospace Company, Buffalo, NY; Martin Marietta, Orlando, FL; Accurex Corporation, Mountain View, CA; TRW, Inc., Redondo Beach, CA; Fairchild Industries, Farmingdale, NY; Grumman Aerospace Corporation, Bethpage, NY; and Calspan Corporation, Buffalo, NY. There is a total of 25 contracts all performed by these contractors.

1. (U) FY 1980 and Prior Accomplishments: Work has continued toward providing long life high performance on-orbit propulsion for satellites. Monopropellant thruster technology has been demonstrated to provide a million pulse life goal without degraded performance; this represents a 100% improvement over previous technology and equates to 10 years of on-orbit life. Technologies demonstrated at the component level provide for up to 20% improvement in payload capability for future low-earth-orbit-to-synchronous orbit transfer vehicles. Carbon-carbon nozzle material and extendible exit cone technology demonstrated in this program were adopted for the Air Force/National Aeronautics and Space Administration Space Shuttle Inertial Upper Stage to provide a needed increase in system performance.
2. (U) FY 1981 Program: Develop high performance monopropellant heater technology and a 0.001 lb thrust pulsed plasma electric thruster for long life satellites. Continue development of gas deployed skirt and extendible exit cone to provide high performance options for space launch motors.
3. (U) FY 1982 Planned Program: The pulsed plasma electric satellite thruster will transition to an advanced technology demonstration program. Continue high performance thruster development. Initiate development of a non-carcinogenic high performance nitro-methane monopropellant. Initiate component development for long-burn liquid rocket upper stages for use with the Space Shuttle. Continue developing propulsion growth options for space defense.

Project: #3058

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Space Systems Propulsion Technology

Title: Rocket Propulsion

Budget Activity: Technology Base #1

4. (U) FY 1983 Planned Program: Complete upper stage propulsion option for space defense. Initiate component development to support advanced military space vehicle concepts. Initiate component development for high response maneuvering propulsion and reusable satellite propulsion.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	4,979	6,000	7,000	10,500	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

4,700	5,500	7,000	Continuing	Not Applicable
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Project: #3059

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Ballistic Missile Propulsion

Title: Rocket Propulsion

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides proven propulsion technology for advanced ballistic missiles. Principal efforts include the development and demonstration of propellant options, lightweight nozzle and case options to provide up to 10% range or payload increase; post boost propulsion systems to increase the accuracy and flexibility of weapons delivery system; and technology to enhance reentry vehicle accuracy and survivability. Each of the preceding is being coupled with performance optimization in regard to reliability, service life, life cycle cost, basing modes and development risks.

(U) RELATED ACTIVITIES: Technology base activities in this area are closely coordinated with the Navy and the Air Force Ballistic Missile Organization. Present and planned programs are closely coordinated through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee. This project will provide a technology base for PE 63302F, Advanced Missile Propulsion, and also supports: PE 63311F, Advanced Ballistic Reentry Systems and PE 64312F, M-X.

(U) WORK PERFORMED BY: Air Force management of this project is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. The contractors in FY 1980 were: United Technologies/Chemical Systems Division, Sunnyvale, CA; Aerojet Company, Sacramento, CA; Rockwell International, Canoga Park, CA; Thiokol Chemical Corporation, Brigham City, UT; Ehrenpreis, Fort Lee, NJ; Bell Aerospace Company, Buffalo, NY; United Technologies Research Center, East Hartford, CT; Aerotherm Corporation, Mountain View, CA; Atlantic Research Corporation, Alexandria, VA; Fluorochem, Inc., Azusa, CA; Southern Research Institute, Birmingham, AL; Hercules, Inc., Magna, UT. There is a total of 32 contracts, all performed by these contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Demonstrated a nozzle design concept that packages very high expansion ratio exit cones in a minimum length; the concept will be used in the second and third stages of the MX missile with payload improvements of 20% over conventional designs. A comprehensive carbon/carbon composite nozzle component development program has significantly reduced the risk in the MX development; the resulting technological readiness is applicable to space motor application as well as advanced ballistic missiles. During FY 1980 tests demonstrated the outstanding aging behavior (essentially no change with 20 years of accelerated aging) of the Hydroxyterminated Polybutadiene (HTPB) solid propellant developed in previous efforts. These propellants have improved mechanical properties which allow maximization of booster performance and will be used in the first and second stages of the MX missile.

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Project: #3059

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Ballistic Missile Propulsion

Title: Rocket Propulsion

Budget Activity: Technology Base #1

2. (U) FY 1981 Planned Program: Continue development of high energy fluorine based propellants (replacing inert components with energetics) and extremely lightweight case components.
3. (U) FY 1982 Planned Program: Continue development of high performance, reduced cost options for advanced ballistic missiles. Continue low torque nozzle/thrust vector control system as a low cost option for non-vertical launch. Develop erosion resistant carbon-carbon nozzles.
4. (U) FY 1983 Planned Program: Continue advanced carbon/carbon nozzle development. Continue high performance propellant development. Initiate propulsion component development for advanced payload delivery systems.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.
7. (U) Resources: (\$ in thousands)
- | | <u>FY 1980
Actual</u> | <u>FY 1981
Estimate</u> | <u>FY 1982
Estimate</u> | <u>FY 1983
Estimate</u> | <u>Additional
to Completion</u> | <u>Total
Estimated
Costs</u> |
|--|---------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------------|--------------------------------------|
| | 4,943 | 4,700 | 5,000 | 6,100 | Continuing | Not Applicable |
8. (U) Comparison with FY 1981 Budget Data:
- | | <u>5,600</u> | <u>7,000</u> | <u>7,800</u> | <u>Continuing</u> | <u>Not Applicable</u> |
|--|--------------|--------------|--------------|-------------------|-----------------------|
| | | | | | |
- Funding level decrease due to reduced technology support requirements for Missile-X (MX) based on transition to full-scale development.

Project: #3148

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Air-Launched Missile Propulsion

Title: Rocket Propulsion

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides improvements in rocket propulsion technology for future air-launched weapons. Tactical rockets with improved standoff range, better accuracy, improved service life and lower cost are being developed. Strategic air-launched missile performance improvements are being pursued through high energy propellants, energy management and improved thrust vector control. Improved aircraft survivability missile effectiveness will be provided by eliminating missile onservables caused by the propulsion system.

(U) RELATED ACTIVITIES: Army and Navy programs on improved solid propellants and improved components are well coordinated through the Joint Army-Navy-National Aeronautics and Space Administration-Air Force Interagency Propulsion Committee. The Air Force Armament Division has related efforts in the armament propulsion area. This project will provide a technology base for PE 63302F, Advanced Missile Propulsion.

(U) WORK PERFORMED BY: Air Force management of this project is provided by the Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA. The contractors in FY 1980 were: Thiokol Chemical Corporation, Huntsville, AL and Brigham City, UT; Hercules, Inc., Cumberland, MD; Atlantic Research Co., Alexandria, VA; Rockwell International, Canoga Park, CA; McDonnell Douglas, St. Louis, MO; Lockheed, Palo Alto, CA; Martin Marietta, Orlando, FL; Chandler Evans, West Hartford, CT; United Technologies/Chemical Systems Division, Sunnyvale, CA; Stanford Research Institute, Palo Alto, CA; and Aerojet Company, Sacramento, CA. There is a total of 27 contracts, all performed by these contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A solid propellant data base has been developed to determine trade-offs between performance, smoke, and operational limitations for tactical applications. The integration of minimum smoke propellant was demonstrated in an actual motor design including subjecting the motor to a typical air-launched missile environment. A full-scale two pulse radially burning pulse motor was demonstrated over the complete temperature range of -65°F to +145°F for application to air-to-air missiles. An arm-fire device was developed for remote cockpit actuation that offers a 40 percent cost savings over present devices.
2. (U) FY 1981 Program: Develop improved propellants for decreased time-to-target and minimum smoke. Develop energy management systems to increase the off-axis launch envelope.
3. (U) FY 1982 Planned Program: Continue propulsion energy management options (multi-pulse, throttleable, high slew rate thrust vector control). Initiate evaluation and development of high performance prepackaged liquid propulsion with on-demand throttling. Develop minimum smoke propellant with increased burn rate flexibility.

Project: #3148

Program Element: #62302F

DOD Mission Area: Engineering Technology (ED), #523

Title: Air-Launched Missile Propulsion

Title: Rocket Propulsion

Budget Activity: Technology Base #1

4. (U) FY 1983 Planned Program: Continue pre-packaged liquid propellant technology development and propulsion energy management options. Complete minimum smoke motor (propellant, liner, ignitor) demonstration.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
	7,175	7,100	8,000	11,000	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>						
	6,800	7,600	8,600		Continuing	Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521 Title: Advanced Weapons
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT								
		32,600	37,410	42,863	48,755	Continuing		
06CB	Laboratory Operations	11,989	12,310	13,333	13,582			
1900	Environmental Quality Technology	1,300	1,500	1,800	2,000			
2007	Nuclear Safety	724	900	1,000	1,100			
2218	Laser Survivability/Vulnerability Technology	465	600	600	800			
2444	Integrated Computational Center	772	700	600	200			
2673	Civil Engineering Technology	0	300	500	800			
3326	Laser Applications	10,948	12,600	14,100	16,973			
5797	Advanced Weapons Concepts	1,139	2,900	4,600	5,300			
8809	Nuclear Survivability/Vulnerability Technology	5,263	5,600	6,330	8,000			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the technology base for advanced weapons and their adaption to Air Force systems. Studies and experiments are conducted in laser applications, survivability/vulnerability, advanced weapon concepts, nuclear weapons environment, civil engineering technology, and environmental quality. Operation and maintenance of the Air Force Weapons Laboratory at Kirtland Air Force Base NM are also included.

BASIS FOR FY 1982 RDT&E REQUEST: Complete construction of the radial line electron accelerator, RADLAC II. Begin critical experiments to demonstrate atmospheric propagation and lethality of one or two high current pulses of high energy electrons. These experiments are key milestones in the Department of Defense program to determine feasibility of advanced particle beam weapons. Continue assessment of the hostile nuclear weapons environment and its effect on United States systems. Continue development of chemical laser and critical beam control concepts.

Program Element: #62601F
 DOD Mission Area: Electronic & Physical Sciences (ED), #521
 Title: Advanced Weapons
 Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	31,900	36,900	41,000		Continuing	Not Applicable
Military Construction			6,590			

(U) OTHER APPROPRIATION FUNDS:

Military Construction (\$ in thousands) 6,800

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Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Advanced Weapons

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: Provides the Air Force with a sound technology base for the development of advanced weapons and their adaption to systems. Investigations and experiments are conducted in laser weapon technology, survivability/vulnerability of Air Force systems to high energy laser and nuclear weapon threats, nonconventional weapon concepts, nuclear weapon effects, and environmental quality technology. Includes operation and maintenance of the Air Force Weapons Laboratory. The technology developed helps prevent technological surprise by other nations. Also provides technical support to other Air Force and Department of Defense agency programs and receives partial reimbursement for services provided. Basic research accomplished by the laboratory is fully reimbursed by Program Element 61102F, Defense Research Sciences. The project break reflects the best estimate anticipating reimbursements, but may require adjustment to the degree that reimbursements are actually earned.

(U) RELATED ACTIVITIES: Nuclear weapons effects are closely coordinated with programs funded by the Defense Nuclear Agency Program Element 62704H and the Defense Advanced Research Projects Agency Program Element 62301E. Technology developed through these programs directly supports increased nuclear survivability efforts for Minuteman Missile Program Element 11213F, Advanced Ballistic Reentry Systems Program Element 63311F, and Air Force Systems Survivability (Nuclear Effects) Program Element 64711F. Exploratory laser development supports the Air Force Advanced Radiation Technology Program Element 63605F. Civil and environmental engineering technology efforts directly support the Civil and Environment Engineering Technology Advanced Development Program Element 63723F.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory at Kirtland Air Force Base NM manages most of the work performed under this program element. The Engineering and Services Laboratory at Tyndall Air Force Base FL manages Project 1900, Environmental Quality Technology, and Project 2673, Civil Engineering Technology. Air Force Weapons Laboratory facilities involved in the work include the Impact Facility, Sandia Optical Range, the Laser Laboratory, the SHIVA Electromagnetic Implosion X-Ray Source, the Dipole and TRESTLE electromagnetic pulse simulators and the Civil Engineering Research Facility. Engineering and Services Laboratory facilities include the Environmental Chemistry Research Laboratory. The ten major contractors in FY 1980 were: University of New Mexico, Albuquerque, NM; Bell Aerospace, Buffalo, NY; R&D Associates, Santa Monica, CA; Mission Research Corporation, Santa Barbara, CA; Dynallectron Corporation, Holloman AFB, NM; TRW, El Segundo, CA; University of Dayton, Dayton, OH; International Laser Systems Incorporated, Orlando, FL; Systems Development Corporation, Santa Monica, CA; and BDM, McLean, VA. A total of 66 contracts and 42 contractors were involved in this program element in 1980.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Air Force Weapons Laboratory has conducted an extensive series of programs to assess and minimize the effects of nuclear weapons on key United States strategic, tactical, and command, control and communication systems. Emphasis has been placed on better definition of nuclear weapon attack environments; development of simulation concepts and techniques, specific system assessments, and development of improved technology for increased nuclear survivability. Several high energy laser concepts developed under this program have been transitioned into advanced development. An active program to explore new weapons applications has included studies and experiments in charged and neutral particle beams and high power electromagnetic waves. The environmental quality

Program Element: #62601F

Title: Advanced Weapons
Budget Activity: Technology Base, #1

DOD Mission Area: Electronic & Physical Sciences (ED), #521

efforts at the Engineering Services Laboratory have led to analytical models to characterize and minimize environmental impact of Air Force operations.

2. FY 1981 Program: Results of nuclear weapons effects research must be transitioned into aerospace system development, acquisition, and operation. To satisfy this requirement, several efforts in this program element are continuing level of effort programs: systems support, which includes assessing nuclear survivability and associated hardening costs for new systems, such as the B-52 Cruise Missile Carrier, Advanced Ballistic Reentry Vehicle and the Strategic Satellite System; radiation hardened electronics; materials evaluation and nuclear environment definition; and simulator development, with emphasis on the electromagnetic implosion concept (SHIVA). Electromagnetic pulse technology issues will be addressed by a review of experimental discharge data from electron interaction and materials interaction studies. Efforts in the High Energy Physics Technology Program will continue to support the Undersecretary of Defense for Research and Engineering particle beam program with studies in beam sensing, pointing and tracking, point design and mission analysis, power supply development, and electron beam accelerator development and experiments with the radial line accelerators RADLAC I and II. Laser applications efforts will continue to emphasize the oxygen-iodine chemical laser. The study of repetitively pulsed laser effects on beam control systems will continue. The Civil Engineering Technology project will be initiated to develop technology for advanced Air Force civil engineering requirements. Initial efforts will address rapid repair technology for battle-damaged airfield pavements.

3. FY 1982 Planned Program: Primary new advanced weapons programs include the second generation radial line electron accelerator (RADLAC II), the laboratory oxygen-iodine continuous-wave laser, the SHIVA II electromagnetic implosion nuclear weapon x-ray simulator, and the nuclear weapon safety assessment of the Cruise Missile Carrier Aircraft. These programs provide the Air Force's only long range technology base enhancements for the nuclear and non-conventional weapons development essential to continued technological superiority. Continued efforts include refinement of understanding of the hostile nuclear weapons environment and its effect on United States systems, specifically the Advanced Intercontinental Ballistic Missile System and the Medium Range Ballistic Missile. High Energy Laser technology development will continue to emphasize advanced chemical laser concepts, including pulsed deuterium fluoride, with the goal of transitioning to advanced development. This work will be paralleled by development of critical beam control components and adaptive optics demonstrations involving advanced tracking and non-linear concepts. Efforts to develop new structural materials for rapid repair of battle damaged Air Force runways will continue in the civil engineering technology project. Our program to assess and minimize environmental impact of Air Force unique operations on surrounding air, water, and land resources will be extended, with emphasis on consequences of using alternate fuels. Nuclear safety analyses of the F-111F Stretch Aircraft, F-16 Block III Aircraft, the B-52 Offensive Avionics Suite for the Air Launched Cruise Missile Carrier, and the General Purpose Heat Source for the Space Shuttle program will be completed and the results transitioned to the field.

4. FY 1983 Planned Program: The efforts in nuclear weapons effects will emphasize the conversion of available effects data into design criteria which will increase survivability of United States systems. Efforts to understand the life cycle implications and develop criteria, techniques, and procedures which will maintain the hardness throughout the life cycle of systems will also be pursued. Refinement of the nuclear environment and exploration of the phenomenology of special effects weapons to understand impact on United States systems will be continued. Air Force support of the Department of Defense particle beam weapon feasibility study will continue with electron beam

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Advanced Weapons

Budget Activity: Technology Base, #1

propagation studies using RADLAC II (25 million electron volts; 100,000 amperes) and the testing of a 2 million watt power source to be completed in FY 1983. High Energy Laser efforts will be directed to'

Environmental quality efforts will include interfacing of the Water Quality and Air Quality Assessment models, and new concepts for smoke reduction using fuel additives. New or continuing civil engineering efforts on materials and techniques for enhanced rapid runway repair, on structural survivability, and on soil reinforcement for contingency operations will receive emphasis. Development of an integrated computational support system to permit multilevel security data processing will be completed in FY 1983.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

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Project: #06CB

Program Element: #62601P

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Air Force Weapons Laboratory Operations

Title: Advanced Weapons

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Air Force Weapons Laboratory, Kirtland Air Force Base NM. The Air Force Weapons Laboratory is responsible for exploratory, advanced, and engineering development programs associated with nuclear and other nonconventional advanced weapons including studies of effective delivery techniques and hazards of these weapons. The Laboratory provides technical support to current and future systems programs and undertakes operational support projects in its mission areas. This project provides for the pay and related costs of civilian scientists, engineers, and supporting personnel; travel and other transportation; rent, communications and utilities costs; procurement of supplies and equipment; and contractor support services.

(U) RELATED ACTIVITIES: This project supports and complements all of the technical projects under this program element as well as other projects and programs managed by Air Force Weapons Laboratory, such as: Advanced Radiation Technology Program Element 63605P; Systems Survivability (Nuclear Effects) Program Element 64711P; Nuclear Effects Simulation Test Facilities Program Element 64747P, Project 1209; Air Force projects under the Defense Nuclear Agency's Nuclear Weapons Effects Program Element 62704H; Defense Advanced Research Projects Agency Strategic Technology Program Element 62301E; and related nuclear hardness testing and survivability developments.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base NM, is the organization responsible for management of this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) Accomplishments and Future Programs: Accomplishments and future programs for this support project are covered in the Descriptive Summary for the overall program element.

2. (U) Program to Completion: This is a continuing program.

3. (U) Milestones: Not Applicable.

4. (U) Resources (\$ in thousands):

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RD&E Funds	11,989	12,200	13,333	13,582	Continuing		

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Project: #06CB

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Air Force Weapons Laboratory Operations

Title: Advanced Weapons

Budget Activity: Technology Base, #1

5. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982	Total
		Estimate	Estimate	Estimated
				Costs
RDT&E Funds	11,300	12,200	12,400	Continuing
				Not Applicable

Change in FY 1982 reflects the additive cost of the 1 October 1980 civilian pay raise and revised estimates of reimbursement for support provided to other programs and agencies.

Project: #3326

Program Element: #62601P

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Laser Applications

Title: Advanced Weapons

Budget Activity: Technology Base, #1

DETAILED BACKGROUND AND DESCRIPTION: This project provides exploratory development to establish the technical feasibility and operational practicability of lasers as weapons to fulfill specific Air Force mission requirements. Included in the scope of this project are the study of advanced laser device concepts for including chemical and electric discharge lasers; the investigation and analysis of advanced adaptive optics concepts; diagnostic evaluation, modeling, and kinetics study for the hydrogen fluoride/deuterium fluoride chemical laser; the development of repetitively-pulsed deuterium fluoride chemical laser technology; material, component, and fabrication technology development for high energy laser optical components; the investigation of repetitively-pulsed high energy laser effects; and studies and analysis of potential applications of high energy laser systems.

(U) RELATED ACTIVITIES: This project is part of a Department of Defense program which is coordinated by the Under Secretary of Defense for Research and Engineering, Research and Advanced Technology, and which includes work in Defense Advanced Research Projects Agency Program Elements 62301E, Strategic Technology, and 62711E, Experimental Evaluation of Major Innovative Technology; Army Program Element 62307A, Laser Weapon Technology; Navy Program Elements 62735N, High Energy Laser Technology, and 62768N, Directed Energy Technology; and Air Force Program Element 63605F, Advanced Radiation Technology. Coordination with Department of Energy programs is effected by attendance at the Department of Energy technical program reviews, exchange of technical publications, and cooperative efforts at the working level.

(U) WORK PERFORMED BY: This project is managed by the Advanced Radiation Technology Office of the Air Force Weapons Laboratory, Kirtland Air Force Base NM. A considerable portion of the work is accomplished with participation by the Air Force Materials Laboratory, Air Force Office of Scientific Research, Air Force Space Division, National Bureau of Standards, Naval Weapons Center, Naval Research Laboratory, Army Missile Research and Development Command, and the Department of Energy. Major contracts supported by these funds in FY 1980 were issued to: Bell-Aerospace, Buffalo NY; Rockwell Rocketdyne, Canoga Park CA; Boeing, Seattle WA; TRW, Redondo Beach CA; and Dynallectron, Albuquerque NM.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Chemical laser technology has continued to progress with the demonstration of 100 kilowatts of power from a hydrogen fluoride laser device exhibiting good beam quality. Work with advanced fuels and nozzle bank concepts has identified improved nozzle bank technology and has characterized substitute fuels particularly nitrogen trifluoride. In addition, significant progress has been made in establishing the data base for kinetic rates and laser performance and in developing computer models for hydrogen fluoride/deuterium fluoride chemical lasers. Technology investigations in new laser concepts have uncovered a number of potential concepts, such as iodine, nitrogen fluoride, and iodine monofluoride. Particularly notable has been the successful demonstration of lasing from a chemically-pumped oxygen-iodine laser at 1.315 micrometers wavelength; laboratory-scale testing demonstrated 150 watts.

Report 01126

Program Element: #62601F

DDO Mission Area: Electronic & Physical Sciences (ED), #521

Title: Laser Applications

Title: Advanced Weapons

Budget Activity: Technology Base, #1

development of optical components, optical coatings for laser wavelengths have been developed and tested at high power;

potential for significantly reducing time and cost for fabrication with the micro-machining techniques for mirror fabrication with the begun on the development of coatings and window materials

been made in the development of computer codes for laser resonator analysis, particularly for cylindrical geometry. Studies have been carried out on the potential applications of adaptive optics concepts. Work has begun on the development of advanced deformable mirror concepts and experiments have been initiated for the study of non-linear adaptive optics techniques. A number of applications studies for high energy lasers have been completed.

In the

high reflectance at carbon dioxide

2. FY 1981 Program: The investigation of advanced concepts will continue, and supporting efforts in effects/vulnerability, theoretical modeling, and applications analysis will be pursued. Particular emphasis will be placed on the development of the iodine laser system.

Other new laser concepts will be investigated, including laboratory experiments to develop an efficient generator for excited magnesium atoms and the investigation of concepts for an iodine monofluoride chemical laser. Work will continue in the development of the technology base for hydrogen fluoride/deuterium fluoride chemical lasers, including the start of the laboratory evaluation of an optical resonance transfer laser concept, modeling development for advanced nozzle concepts, and kinetic rate measurements.

--- In the development of optical components, efforts in developing coatings and window materials will continue, and work will begin on the development of advanced grating fabrication techniques. Repetitively-pulsed laser effects testing will continue complementary theoretical work will investigate damage mechanisms. Optical systems analysis techniques will continue to be improved, and advanced beam control system concepts will be investigated. In particular, work will begin on the conceptual definition of a beam control system high power applications for non-linear adaptive optics will be investigated. Applications analysis will continue, investigating applications of high energy laser weapon systems and developing improved engagement models.

3. FY 1982 Planned Program: The evaluation of advanced laser device concepts will continue as promising candidates are investigated to establish performance and scalability

Project: #3326

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Laser Applications

Title: Advanced Weapons

Budget Activity: Technology Base, #1

possible in the investigation of excited magnesium transfer laser concepts, the nitrogen fluoride chemical laser, and other promising chemical laser concepts. Work with hydrogen fluoride/deuterium fluoride chemical lasers will continue with the evaluation of the optical resonance transfer laser concept. Beam control system requirements will be considered in greater detail in terms of optical components advanced tracking concepts, improved resonance designs, optimum stabilization/damping methods, and application of adaptive optics techniques. Applications analysis will be used to evaluate technology advances.

Significant efforts are also

the evaluation of the optical

will be considered

advanced tracking concepts, improved

application of adaptive optics techniques. Applications

analysis will be used to evaluate technology advances,

4. FY 1983 Planned Program: The emphasis

breadboard demon-

strations as subsystem technology becomes available.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Funds	10,948	12,600	13,567	16,973	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	10,900	12,500	13,900	Continuing	Not Applicable
RDT&E					

Planned increases for FY 1982 incorporate less than inflationary growth, resulting in delay of new technology efforts in iodine lasers.

Project: #8809

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Nuclear Survivability/Vulnerability Technology

Title: Advanced Weapons

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The goal of this project is to provide an effective transfer of technology gained from nuclear weapons effects research into concrete steps to increase the survivability of Air Force systems to nuclear encounters. To effect this transfer, the hardness of Air Force systems as built or conceived will be assessed and support will be provided to assure that hardness levels are included in the system from concept selection through operational use. This life-cycle survivability program will include studies on the phenomenology of special effects, the determination of appropriate hardening levels for the system being acquired, the implementation of hardening techniques through the program office acquiring the system, the assurance that hardening levels established have been reached by verification, and the maintenance of these hardened levels throughout the operational lifetime of the system. This process will be accomplished through five major areas of effort: system support, materials evaluation and environment definition, development of radiation hardened electronics for advanced Air Force weapons systems, development of the technology required to simulate nuclear weapon X-ray environments, and special studies of technology impacts and applications.

(U) RELATED ACTIVITIES: This project provides essential parts of the technology base in weapon system survivability/vulnerability and for efforts funded by program offices such as Advanced Ballistic Reentry Systems Program Element 63311F; M-X Program Element 64312F; Air-Launched Cruise Missile Program Element 64361F; Defense Support Program Element 12431F; Nuclear Effects Simulation Test Facilities Program Element 64747F, Project 1209; and Systems Survivability (Nuclear Effects) Program Element 64711F. The project is also related to Research and Development sponsored by the Defense Nuclear Agency, the Air Force Office of Scientific Research, and other military development/operational agencies.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base NM, manages this project and performs some of the work in-house. Major contracts supported by these funds in FY 1980 were issued to: Computer Sciences, Cambridge MA; Dames and Morrie, Los Angeles CA; Systems Science and Software, La Jolla CA; SKM, Boston MA; McDonnell Douglas, Long Beach CA; and Effects Technology, Santa Barbara CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: System program offices were provided the technology support required to establish and conduct survivability/vulnerability programs. Assistance was given to the various survivability/vulnerability reviews of designated Air Force systems. Criteria and/or hardening/survivability recommendations were developed for several current and proposed Air Force systems, including Air Launched Cruise Missile, Advanced Intercontinental Ballistic Missile, E-4, B-52, and F-16. Improvements in computer codes to model the responses of aircraft to blast were completed. To improve the capability to perform vulnerability and hardening assessments of reentry vehicles and missile systems, development of a computer system was started, which includes the Nuclear Hardness Evaluation Procedures methodology, material properties and weapons tests. Materials and environmental development efforts included characterization of new reentry vehicle materials. Materials and hardened electronics support were provided for such systems as Advanced Ballistic Reentry Vehicle, Advanced Intercontinental Ballistic Missile, and Advanced Maneuvering Reentry

Project: #8809

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Nuclear Survivability/Vulnerability Technology

Title: Advanced Weapons

Budget Activity: Technology Base, #1

Vehicles through the Advanced Reentry Vehicle Survivability Technology Support Program. Radiation hydrodynamics work included theoretical studies to define more complex nuclear-induced environments to support reentry vehicle targeting studies, strategic structure design, and deep basing studies. Work continued to improve computer codes for shielding calculations and rate dependent space environment effects studies were undertaken. Under the Radiation Hardened Electronics program, hardening and assessment techniques for advanced electronic technologies continued. Optimization of the SHIVA electromagnetic implosion X-ray facility began, and techniques for obtaining shorter pulses and higher energy X-ray output were investigated. Development of techniques for applying new technologies to Air Force missions through the Advanced Intercontinental Ballistic Missile System Technology Requirements Program continued.

2. (U) FY 1981 Program: Technology support to the systems program offices will continue. Criteria and hardening recommendations for current and proposed systems will continue from FY 1980 or, in some cases, be initiated in FY 1981. FY 1981 systems will include the Advanced Strategic Air-Launched Missile, E-4, B-52, Ground Launched Cruise Missile, and Global Positioning System. The design hardness assessment of the Advanced Ballistic Reentry Vehicle begun in FY 1979 will be completed. The methodology for predicting the structural response of reentry vehicle materials will be improved as will the techniques for simulating X-ray effects on these materials. Materials and hardened electronics support will continue through the Advanced Reentry Vehicle Survivability Technology Support Program. Computer code improvements to the Structures/Medium Interactions code will be completed. Under the Radiation Hardened Electronics program the photodetector and linear circuit hardening assurance efforts will be completed and semiconductor laser diode hardening work will begin. Work to develop improved X-ray sources will continue in the areas of advanced power technology, load technology, and enhanced radiation technology.

3. (U) FY 1982 Planned Program: Technology support to program offices will continue with emphasis on the Advanced Intercontinental Ballistic Missile. Preparation of nuclear hardness specifications and nuclear hardness assurance reports and guidance will be accomplished for the E-4, Advanced Intercontinental Ballistic Missile, and Navy TACAMO aircraft. Criteria development by the Nuclear Criteria Group Secretariat will continue for designated systems. These are likely to include Medium Range Ballistic Missile, Space Defense System Program, the Defense Meteorological Satellite Program, and the Penetrating Manned Bomber. SHIVA electromagnetic implosion X-ray source activities will continue with fabrication, and load and power system tests. SHIVA II upgrade will be completed in FY 1982. Deep missile basing concepts will be studied. Electromagnetic pulse technology issues will be addressed by cable response computations, development of material property standards, incorporation of multiburst and hydrodynamic effects into Air Force Weapons Laboratory Electromagnetic Pulse codes. Materials and hardened electronics support will continue through the Advanced Reentry Vehicle Survivability Technology Support Program. Under the Radiation Hardened Electronics program, linear circuit hardening assurance efforts, electro-optical component hardening and advanced memory hardening efforts will continue.

4. (U) FY 1983 Planned Program: The efforts in nuclear weapons effects will continue to emphasize the conversion of available effects data into design criteria which will increase the survivability of United States systems. Efforts to understand the life cycle implications and develop criteria, techniques, and procedures which will maintain the hardness throughout the life cycle of systems will also be pursued. Refinement of the nuclear environment and

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Project: #8809

Program Element: #62601F

DOD Mission Area: Electronic & Physical Sciences (ED), #521

Title: Nuclear Survivability/Vulnerability Technology

Title: Advanced Weapons

Budget Activity: Technology Base, #1

exploration of the phenomenology of special effects weapons to understand impact on United States systems will also be continued. Criteria development by the Nuclear Criteria Group Secretariat for those systems designated by the Nuclear Criteria Group will continue. Application of Nuclear Hardness Evaluation Procedures Methodology to additional systems is anticipated. Experiments will continue using the upgraded SHIVA II. Research on the theoretical and experimental methods for predicting X-ray response of advanced reentry material will continue. Hardness assurance efforts for large scale integrated circuits and electro-optical components will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,263	5,500	6,000	8,000	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	5,100	5,510	6,200	Continuing	Not Applicable
RDT&E					

The FY 1981 and FY 1982 programs remain basically as planned. Growths in funding are less than inflation, impacting the level of effort for the continuing Radiation Hardened Electronics effort.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62602F

Title: Conventional Munitions

DOD Mission Area: Engineering Technology (EP), #523

Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1983 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
06CD	TOTAL FOR PROGRAM ELEMENT	30,125	29,500	33,300	39,900	Continuing	Not Applicable
	Air Force Armament Laboratory Operations	10,674	11,003	12,001	12,269		
2068	Guided Weapons Technology & Simulation	7,862	8,097	8,406	11,304		
2502	Munitions Dispensers & Component Technology	4,954	4,500	5,300	6,900		
2543	Weapon Evaluation/Effects Methodology	3,037	2,100	2,493	3,000		
2560	Direct Fire Weapons Technology	2,501	2,400	3,000	3,700		
2567	Weapons Carriage and Release Technology	1,097	1,400	2,100	2,727		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program establishes a technology base to support tactical air-to-surface and air-to-air guided weapons development; design and feasibility demonstration of advanced air-delivered munitions, including cluster munitions, warheads, fuzing, and target activated munition technology; development of new and improved weapon evaluation methodologies and their supporting data bases; advancement of the state-of-the-art in aircraft guns, rockets, ammunition, ancillary support equipment, new propellants and explosives; and development of effective stores management, aircraft/store interfacing techniques, supporting system software, and new assessment techniques for predicting behavior of proposed aircraft/weapon configurations. This program also provides for the operational support and management of Air Force Armament Laboratory at Eglin Air Force Base, FL. The program element also provides funding support for the operation of the Guidance and Control Information Analysis Center.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program is the entire Air Force exploratory development capability in aerially delivered non-nuclear munitions and ancillary support equipment for future weapon applications. The program to be pursued in FY 1982 includes the following new starts: ADVANCED GLOBAL POSITIONING SYSTEM ANTENNA TECHNOLOGY, the payoff being to improve missile performance in the face of heavy jamming; SIGNAL PROCESSING TECHNOLOGY which will define characteristics for a new generation of missile-compatible processors for the 1990's for guided systems; VELOCITY UPDATE TECHNOLOGY which will investigate new sensor schemes for velocity updating enroute to the target for longer-range guided weapons; MODERN PROGRAM/LANGUAGE CONCEPTS, needed to determine impact of new program concepts on the architecture of midcourse guidance applications of the 1990's; AIR-TO-AIR MISSILE OPTIMUM CONTROL, will determine the applicability of current research techniques to developmental air-to-air missiles; IR MEASUREMENTS to update the DOD IR data bank for evaluation of current and future seeker designs; ALGORITHMS DEVELOPMENT TO IMAGING PROCESSING will develop acquisition, lock-on, and tracking techniques for air-to-air and air-to-surface applications; LASER BEAM STEERING will develop advance laser and seeker techniques using magnetic fields to investigate carbon dioxide laser technology for air-to-ground applications; SENSOR TECHNOLOGY to develop the vehicle to assess advanced sensor technology for missiles for the 1990's; LIGHT GAS GUN, the payoff being

Program Element: #62202F

DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions

Budget Activity: Technology Base, #1

the development of technology for launching projectiles at muzzle velocities over two times greater than current capability; FUZE/WEAPON INTERFACE TECHNOLOGY to determine if information contained in other missile subsystems can be used for solving fuze related problems; ADVANCED DIGITAL TECHNOLOGY which will provide greater flexibility to adapt to changing requirements for fuze applications; LIGHT AND HEAVY ARMOR PENETRATION TECHNOLOGIES for optimizing warheads for the defeat of advanced armors; COMPOSITE MATERIALS TECHNOLOGY versus FRAGMENTATION WARHEADS to assess the impact of increased use of composite materials in aircraft structures on the effectiveness of fragmentation warheads; BUNKER PENETRATION MECHANICS to defeat deeply buried very hard targets; ADVANCED KILL MECHANISMS for exploring new lethal mechanisms for air-delivered ordnance; DISPENSER CONFIGURATION TECHNOLOGY to develop more effective and less expensive cluster munitions; SUPERSONIC DISPERSION TECHNOLOGY for techniques to disperse submunitions above sonic speeds; RESOURCES CONCENTRATION SUBMUNITION to defeat production facilities and resource concentration targets; CRUISE MISSILE SUBMUNITION to optimize the Cruise Missile for conventional warfare; AIRFIELD ATTACK TECHNOLOGY to provide a new submunition concept for defeat of airfields; NON-CIRCULAR STORE AERODYNAMICS to predict aerodynamic characteristics of non-circular body stores; INTERFERENCE DRAG to predict increased drag due to various store configurations; and SEPARATION AERODYNAMICS to develop store separation methods for advanced fighter concepts. Emphasis will continue to be placed on those existing efforts that will provide a technology base for defeat of radiating and shutdown communications, radar equipment, and advanced armor. Technology efforts oriented to within visual range air-to-air missiles will be continued. Emphasis on beyond visual range has been expanded to include concepts for defeat of standoff jammers, maneuvering, and high altitude targets.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
		Estimate	Estimate	Estimate	to Completion	Estimated Costs
RDt&E	FY 81 Submit	29,600	29,500	32,700	Continuing	Not Applicable

Funds have been added to this program since the submission of the FY 1981 Descriptive Summary. These funds are to increase emphasis in electro-optical terminal guidance technology, emitter seeker concepts, strapdown seeker and midcourse weapon technologies, and development of a simulation capability for evaluation of digital subsystems in weapons. Emphasis will also be increased on technologies that relate to defeat of advanced armor. This includes warheads and dispenser concepts. Changes are also reflected in the FY 1982 program due to the 1 Oct 80 civilian pay raise, revised estimates of reimbursements for support provided to other programs and agencies, upgrading in-house facilities and the goal to achieve 5% real growth in the total Air Force Exploratory Development Program.

(U) OTHER APPROPRIATION FUNDS:

MILITARY CONSTRUCTION (\$K)

300

(118)

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Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The purpose of this program element is to provide the Air Force with superior air-delivered non-nuclear weapons to meet long range military and national objectives. The benefit to be derived from non-nuclear weapon technologies (fundamental technology development to sophisticated breadboard hardware) is to quantify, with a high degree of accuracy, the military capability and effectiveness that could be provided by converting the technology into weaponized form. Concepts and techniques are explored to meet the ever increasing Soviet armor threat. Advanced armor in the post 1990 time frame will require sophisticated efficient low cost-destruction mechanisms with greatly improved ability to penetrate armor. Cluster munition, warhead and fuzing efforts will address these requirements to provide improved unit lethality and provide for multiple kills per unit. Accurate near all-weather guided weapon capability for employment against moving and non-moving targets is required. A millimeter wave and infrared measurements data base is being developed to support current and future seeker designs to support this requirement. All three Services will use the millimeter wave and infrared target and background signature data base to improve the results of the seeker developments. The military payoff of these programs will fill the need to identify, designate and direct weapons from terminal guidance systems to selectively destroy targets of military interest while improving aircraft survivability and missile effectiveness. Currently, the Services have a very limited ability to effectively destroy buried command, control, and communications targets. Kinetic energy penetrator concepts and designs will be formulated and evaluated for destruction of these targets. Internal detonation of a high explosive charge would destroy the contents of the command, control, and communications facility.

A military deficiency exists in directing nonconventional weapons which can be applied with precision to engage only targets of military interest in adverse and all-weather operation using on-board midcourse and terminal guidance systems. Increased emphasis will be placed on image processing and pattern recognition to support this need. Examples follow. Efforts are underway to develop advanced millimeter wave seekers for terminal homing. Emitter homing technology is being pursued to locate and track threat radars after transmitter shutdown. Passive and active radio frequency techniques for beyond visual range passive and active seeker all-weather designs will be pursued: A carbon dioxide laser radar and associated three dimensional signal processing and beam steering system will be explored. Emphasis will be centered on aircraft and cruise missiles with autonomous acquisition and target classification with low false alarm rates. The payoff of this effort could improve the survivability of United States weapon systems while improving probability of kill and multiple kills per pass. This program element, in addition to being the only Air Force exploratory development effort in conventional munitions, provides technical support to other Air Force and Department of Defense agency programs and receives partial reimbursement for the services provided. In the case of basic research accomplished by the laboratory, full reimbursement is provided by Program Element 61102F, Defense Research Sciences. The projects reflect the best estimate considering these anticipated reimbursements, but may require adjustment to the degree that reimbursements are actually earned. This program also includes the funds required for the operation and management of the Air Force Armament Laboratory, Eglin Air Force Base, FL.

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Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions
Budget Activity: Technology Base, #1

(U) RELATED ACTIVITIES: This program supports, through advanced technology efforts and simulation, the following Program Elements: 63601F, Conventional Weapons; 63609F, Advanced Attack Weapons; 63602F, Armament/Ordnance Development; 63370F/64416F, Advanced Medium Range Air-to-Air Missiles; 64607F, Wide Area Anti-Armor Munitions; 64604F, Low Altitude Airfield Attack System; 64612F, Low Level Laser Guided Bomb; 64614F, Medium Range Air-to-Surface Missile; 64608F, Close Air Support Weapon Systems; 64601F, Air Delivered Land Mines; 64746F, Expendable Drones. Related Army and Navy advanced technology efforts are coordinated through existing and specially established channels (62332N, Strike Warfare and 62303N, Missile Technology). Technology base efforts are reviewed by the Joint Directors of Laboratories Committee to coordinate related technologies and approaches. The Joint Logistics Commanders and its Joint Technical Coordinating Group for Munitions Development and Munitions Effectiveness provides an additional program coordination channel. There are special coordinating groups such as the Fuze Management Organization, the Under Secretary of Defense for Research and Engineering sponsored Joint Service Guidance and Control Committee, and the Terminally Guided Submunition Group for selected development efforts. These groups are structured to review, on a semi-annual basis, related activities to prevent duplication of identical approaches in related technology programs.

(U) WORK PERFORMED BY: This program is managed by the Air Force Armament Laboratory, Eglin Air Force Base, FL. The Air Force Armament Laboratory has the following in-house facilities: Interior Ballistics Facility, Aeroballistics Research Facility, Ballistics Experimentation Facility, Gun Mechanisms Laboratory, Propellant Evaluation Facility, High Explosives Research and Development Facility, Armament Systems Integration Facility, Structural Dynamics Facility, Missile Simulation Laboratory, Radio Frequency Millimeter-Wave Laboratory, Special Projects Laboratory, Electro-Mechanical Fuze Laboratory, Sensor/Fuze Data Collection and Analysis Laboratory, Hopkinson Bar Facility, Computer and Graphics Analysis Laboratory, Environmental Research Laboratory, Technical Library and Model Shop. The work is performed by industrial contractors, educational institutions, Department of Defense and Department of Energy by contract and in-house. The ten highest dollar value contractors for 1980 were: Boeing Aerospace Corp., Seattle WA; Environmental Research Inst., of MI, Ann Arbor MI; Systems Control Inc., Palo Alto CA; Orlando Tech Inc., Orlando FL; Grumman Aerospace Corp., Bethpage NY; the Analytic Sciences Corp., Reading MA; Chamberlain Mfg Corp., Waterloo IA; General Dynamics, Pomona CA; Southern Tech, Atlanta GA; and General Motors Corp., Goleta, CA. One hundred eleven contracts were distributed among sixty-three contractors. Sixty-four of the 1980 contracts were incrementally funded and/or follow-ons to FY 1979 and prior year contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: (1) RADIO FREQUENCY TARGET SIMULATOR. Radio Frequency Target Simulator operational capability was successfully demonstrated. This provides a realistic radio frequency environment for testing and evaluating active radar guidance seekers. First application of radio frequency target simulator will be in the advanced medium range air-to-air missile analysis/evaluation being performed by the Armament Laboratory; (2) SEISMIC/ACOUSTIC SENSOR: An adaption of the enclosed wire-in-tube used for monitoring seismic activity on base and installation perimeter has been developed which exhibits sensitivity to both seismic and acoustic signals. The simplicity and low cost

Program Element: #62602F

DOD Mission Area: Engineering Technology, #523

Title: Conventional Munitions

Budget Activity: Technology Base, #1

of this transducer compared with a microphone, geophone and associated front end filters make it a viable alternative for weapons applications; (3) ELECTRONIC COUNTERMEASURES RESISTANT FUZE: Two important patentable breakthroughs have been achieved that enhance the electronic counter-countermeasures and counter-countermeasures capability of this concept. The technology is still in the embryonic research & development state, but offers significantly improved solutions to electronic countermeasures, counter-countermeasures, electromagnetic countermeasures and ranging accuracy problems; (4) MINIATURE PRECISION DETONATION: Completed the development and demonstration of a miniature precision detonation for use in safe and arming devices for simultaneous multipoint initiation of missile warheads. This detonator offers an order of magnitude improvement in function speed and repeatability over existing devices and provides the selectable aimable warheads such as the Air Force cylindrical warhead and the Navy selectively aimable warhead; (5) BUNKERED TARGET MUNITIONS: The Bunkered Target Munition exploratory development phase has been initiated to accomplish concept formulation and demonstration of supporting technologies. The bunkered target munition is a weapon to attack hardened underground facilities and consists of a cluster warhead and the Medium Range Air-to-Surface Missile delivery vehicle; (6) ANTIMATERIEL INCENDIARY SUBMUNITIONS: Exploratory development completed. Warhead arena tests were conducted to demonstrate and compare two candidate warhead sizes. The warhead consistently penetrated light armor representative of Soviet armored personnel carriers, self-propelled weapon systems, etc., and demonstrated capability to consistently ignite diesel fuel and artillery ammunition, both in the open and behind light armor; (7) DEPLETED URANIUM ANTIARMOR WARHEAD: Shaped charge warheads using depleted uranium lenses have consistently demonstrated armor penetration far greater than high precision conical copper shaped charges. This warhead concept has the potential of significant performance improvement for a variety of conceptual and developmental antiarmor munitions. This development has the potential to leapfrog and defeat the next generation soviet armor; (8) 3 DIMENSIONAL HYDROCODES: The implementation of 3 dimensional hydrocodes at the Armament Laboratory and on the CRAY-1 computer at the Air Force Weapons Laboratory brings into being a capability to use hydrocodes to treat three-dimensional problems involving oblique and yawed impacts of both monolithic penetrators and structured warheads; (9) FUEL DEFEAT WARHEAD: Numerous agents which polymerize, gel, or emulsify hydrocarbon fuels have been investigated. Several agents have proven to be extremely effective at concentration levels of a few parts per million. If successful, this program could render enemy fuel supplies unusable; (10) INTER-MOLECULAR EXPLOSIVES (FORMERLY NONIDEAL EXPLOSIVES): In addition to a number of technical contributions to the state-of-the-art, the most significant result of this effort to date was an intermolecular explosive system which shows tremendous potential as a replacement fill for general purpose bombs; (11) AIR FORCE EXPLOSIVE: Development of APX-521, a thermally stable booster explosive, was completed. Results showed that APX-521 is thermally stable to 315 degrees Celsius; (12) INSENSITIVE EXPLOSIVES: The task to prepare a test scheme and criteria to evaluate insensitive explosives for 1.5 hazard classification has been completed; (13) DETERRED TRIPLE BASE AND NITRAMINE GAU-8 GUN PROPELLANT: Initial deliveries of advanced propellants specifically tailored for GAU-8 application were received and test fired at the Armament Laboratory's Interior Ballistic Laboratory. Initial firings were highly promising; (14) GUN INSTALLATION TECHNOLOGY: A mechanical hydraulic gun mount servo system for use with the M61A1 gun has been successfully built and tested; (15) GUIDED PROJECTILE CONTROL CONCEPT: Of the six control concepts identified, a unique movable nose control concept was selected for detailed engineering design. The projectile control concept has the potential of increasing expected hits by a ratio of 20 to 1; (16) TARGET AND BACKGROUND MILLIMETER-WAVE/INFRARED MEASUREMENTS: Millimeter wave and infrared signature measurements of tactical targets in typical European backgrounds were acquired during Aug/Sep 80. These data will be used by seeker designers and those working digital models and simulators to refine seeker designs and develop new techniques for enhanced performance.

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions

Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: (1) GUIDED WEAPONS TECHNOLOGY AND SIMULATION: Continue optical rotational sensors effort which includes the micro-optic gyro and the solid state active laser gyro with potential for lower cost, smaller size, and improved performance in inertial guidance systems for guided weapons; Continue emitter homing technology efforts for both air-to-air and air-to-surface applications; Continue to develop the digital subsystem simulation capability; Conduct transmissivity and boresight error slope testing of new weapon radome concepts; Determine feasibility of a passive infrared seeker using a focal plane array with potential for greater acquisition range, all aspect acquisition, terminal accuracy, countermeasures system and target identification for air-to-air missiles; Investigate new concepts that have the potential of providing increased processing capabilities for advanced air-to-air infrared missile guidance; Evaluate strapdown seeker guidance and control algorithms through hardware-in-the-loop simulations. Continue infrared and millimeter wave measurements program. Develop a generic radio frequency mathematical and simulation model for use in evaluation and validation of seeker concepts.

(2) MUNITIONS, DISPENSERS AND COMPONENT TECHNOLOGY. Continue feasibility demonstration of the subnanosecond baseband reflectometry sensor for electronic countermeasures resistant fuzing; Continue evaluation of components for use in advanced dispensers; Evaluate new anti-armor defeat concepts which are capable of defeating advanced armor; Investigate the chemistry in polymerization/gellation/emulsification processes to defeat hydrocarbon fuel targets; Evaluate warhead penetration concepts and fabricate test hardware to measure structural integrity of new materials being considered; Fabricate and air-gun test advanced submunition orientation, positioning, and stabilization devices; Initiate a cooperative antenna technology effort to determine the feasibility of combining the functions of fuzing and guidance antennas; Investigate new fragmentation concepts for unitary warheads; Evaluate target activated sensors and develop target signature and signal propagation models; Continue investigation to determine vulnerability of other vehicles to self-forging fragments. (3) WEAPONS EVALUATION/EFFECTS: Modify and document the warhead lethality analysis model for use in evaluating directional kill warheads; Continue vulnerability tests on jet engines; Obtain a technical description of the Soviet ground support fighter and develop a vulnerability model; Complete efforts to upgrade weapon ballistic, weapon delivery and safe escape methodologies. This data will enable our tactical and strategic sortie planners to accurately determine weapon laydown for combat missions; Initiate preparation of a handbook of information applicable to the vulnerability assessments of hardened targets; Continue to upgrade and expand airfield attack methodologies; Evaluate current computer codes for predicting free stream aerodynamics and update.

(4) DIRECT FIRE WEAPONS TECHNOLOGY: Complete the feasibility demonstration of decoupling and servo stabilization of an M61 gun; Initiate a study of gun aim point stabilization through barrel flexure; Complete design studies of gun mechanism concepts to fire telescoped ammunition; Initiate a study of the feasibility of controlling the trajectory of gun fired projectiles of less than 50mm caliber; Continue work on devices to divert sabots and muzzle gasses away from aircraft; Begin a program to solve the technological problems still facing electromagnetic guns; Study the feasibility of automating hypervelocity light gas guns; Identify new technologies and concepts in guns and rockets which promise significant increase in utility effectiveness; Continue investigation of linear nitramine plasticizers for high energy and low temperature gun propellants for reduced flame temperatures requiring less flash suppressant and higher muzzle velocities for defeat of advanced armors; Continue to develop high energy and insensitive explosives to enhance effectiveness and survivability; Initiate scale up studies of the explosive eutectic of EDD and AN (ethelene diamadintrate and ammonium nitrate) identified in the FY 80 6.1 program. (5) WEAPONS CARRIAGE AND RELEASE TECHNOLOGY: Continue effort to develop an aircraft/store interface integration and validation capability.

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions

Budget Activity: Technology Base, #1

3. (U) FY 1982 Planned Program: (1) GUIDED WEAPONS TECHNOLOGY AND SIMULATION: Establish and maintain a target and background signature data base for support of terminal homing developments in infrared and millimeter wave; provide engineering analysis capability of millimeter wave, infrared, and radio frequency; Investigate innovative millimeter wave hardware and signal processing techniques for anti-armor and high value target terminal homing; Investigate high resolution synthetic aperture radio frequency techniques for application to adverse weather direct strike systems; provide Emitter Homing Technology to support defense suppression and counter command, control and communications seeker development; Investigate passive and active radio frequency techniques for application to beyond visual range passive/active all-weather seeker design; Provide for engineering analysis capability to support hardware-in-the-loop evaluation of technology programs and major missile development programs; Develop low cost inertial sensors which can be used in strapdown inertial reference systems for tactical weapons; (2) MUNITIONS, DISPENSERS AND COMPONENT TECHNOLOGY: Develop and demonstrate the technology for multiple kills per aircraft sortie using (a) low altitude penetration weapon delivery to minimize exposure of attacking aircraft to defensive fire and (b) standoff delivery systems; Develop concepts and technology for improving the effectiveness of sub-munitions in defeat of diesel fueled targets and area targets of resource concentrations; Develop techniques for air-delivered munitions capable of effectively destroying buried command, control, and communication targets; Develop and demonstrate the warhead technology necessary to defeat targets of the 1990s and beyond; Develop fuzes, sensors, and fuzing systems which perform predictably against a variety of targets under environmental extremes as well as hostile countermeasures; Demonstrate technology which minimizes reliance on mechanical components and demonstrate a universal safing and arming device compatible with all air-deliverable weapons; (3) WEAPONS EVALUATION/EFFECTS: Continue development of warhead lethality analysis modeling, vulnerability modeling and testing and the preparation of a handbook of information applicable to vulnerability assessments of hardened targets. (4) DIRECT FIRE WEAPONS TECHNOLOGY: Investigate techniques for guiding and controlling small caliber (50mm or less) gun launched projectiles to enhance hit probability; attack the technological problems in the development of practical hypervelocity guns utilizing light gas and electromagnetic propulsion; Initiate design studies of lightweight guns capable of being installed as stabilized weapons in future small fighters, yet with sufficient lethality and versatility to be employed in the swing role of air-to-air and air-to-surface (anti-armor); Complete the demonstration of technology to divert sabots and gun gases permitting the development and deployment of flechette ammunition effective against the advanced armor threat, complete the demonstration of gun aimpoint stabilization through barrel flexure; develop high energy, insensitive and lower cost explosives to meet current and future systems needs; Develop higher performance gun propellants. (5) WEAPONS, CARRIAGE AND RELEASE TECHNOLOGY: Establish and upgrade the capability for experimentally determining the aerodynamic performance characteristics of developmental weapons; Develop and demonstrate the technology to safely and accurately deliver stores at extremely low altitudes and high speeds including carriage on the upper surfaces of aircraft; Develop an in-house capability and the needed technology to accomplish aircraft/store integration and validation; and develop accurate and cost effective analytical wind tunnel and ground testing techniques to predict the structural and aerodynamic behavior of proposed aircraft/weapon configurations and store separation trajectories. Emphasis will be placed on those efforts that will provide a technology base for defeat of radiating and shutdown communications and radar equipment, and for defeat of advanced armor. Technology efforts oriented to within visual range air-to-air missiles will be continued; emphasis on beyond visual range will be continued including in concepts for defeat of standoff jammers and maneuvering and high altitude targets. Increased funds were added to the program to invest on technologies that relate to defeat of advanced armor. Changes also reflect in the FY 82 program due to civilian pay raise in Oct 80 and upgrade in-house facilities.

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Conventional Munitions

Budget Activity: Technology Base, #1

4. (U) FY 1983 Planned Program: Continue development of midcourse and terminal guidance techniques/subsystems and demonstrate feasibility for application to advanced air-to-surface weapons; provide technology required to develop high performance, low cost air-to-air missiles; improve the technology base for aerodynamic efficiency, stability, control, concept/subsystems, including cluster munitions, warheads, fuzing, and target activated munitions; continue to develop and improve weapon evaluation methodologies, generate data bases to fill voids pertaining to threat aircraft, vehicles and structures; continue to advance the state-of-the-art in aircraft guns, rockets, ammunition, and related components, propellants, and explosives; continue the development of accurate techniques for predicting the behavior of proposed aircraft/weapon configurations and separations; continue the development of effective stores management and inter-operable aircraft/store interfacing techniques; and develop flexible, supporting software.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: #06CD

Program Element: #62602F

DOD Mission Area: Engineering Technology(ED), #523

Title: Air Force Armament Laboratory Operations

Title: Conventional Munitions

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the support activities required to operate the Air Force Armament Laboratory, Eglin Air Force Base, FL. The Air Force Armament Laboratory is the Air Force laboratory responsible for the exploratory and advanced development of non-nuclear conventional munitions. This project provides funds for the pay of civilian scientists, engineers, and support personnel, travel, transportation, rents, communications and utilities costs, procurement of supplies and equipment, contractor support services, and environmental impact studies of munition testing at the Armement Division.

(U) RELATED ACTIVITIES: This project provides in-house support to technical projects under this Program Element and to other projects and programs managed by the laboratory. The Air Force Armement Laboratory is also responsible for: PE 63601F, Conventional Weapons; PE 63313F, Missile Subsystems Technology Integration; and provides technical support to PE 63609F, Advanced Attack Weapons. In addition, it provides technical assistance in armament matters to Systems Program Offices, other laboratories, and the Army and Navy as required.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base, FL, is responsible for the management of projects under this program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) Accomplishments and Future Programs: Programs and accomplishments of the Air For-e Armament Laboratory are discussed in the Descriptive Summary for the Program Element, and for those projects exceeding five million dollars.

2. (U) Program to Completion: This is a continuing program.

3. (U) Milestones: Not applicable.

4. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,674	11,003	12,001	12,269	Continuing	Not Applicable

5. (U) Comparison with FY 1981 Budget Data: (\$ in thousands)

		Continuing	Not Applicable
RDT&E	9,400	9,900	

FY 82 increase due to 1 Oct 80 civilian pay raise.

Project #2068

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Guided Weapons Technology and Simulation

Title: Conventional Munitions

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: In the past this project consisted of guided weapon simulation and analysis support to evaluate various guided subsystems design concepts in a laboratory environment. The objective of Project 2068 is to provide the Air Force with a technology base to support tactical air-to-air and air-to-surface guided weapon development; develop midcourse and terminal guidance techniques/subsystems and demonstrate their feasibility for application to advanced air-to-surface weapons; provide technology required to develop high performance, low cost air-to-surface missiles; continue improvement of the technology base for aerodynamic efficiency, stability, control and overall performance of tactical guided weapons; and provide the Air Force with a capability to evaluate the operational merit and design feasibility of guided weapons in a laboratory environment. The various efforts are directed toward the development of low cost, highly reliable, effective tactical guided weapons which provide maximum tactical flexibility and adverse weather strike capability.

(U) RELATED ACTIVITIES: This project supports Conventional Weapons, PE 63601F; Missile Subsystem Technology Integration, PE 63313F; Advanced Medium Range Air-to-Air Missile, PE 63316F; Advanced Aerial Targets Technology, PE 63232F; and Advanced Attack Weapons, PE 63609F. Guided Weapons Technology efforts are coordinated through the Joint Service Guidance and Control Committee, and the Joint Technical Coordinating Group under auspices of the Joint Logistic Commanders and other formal and informal coordinating groups. The objective of coordination between Services is to maximize technology output through complementary programs.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base FL manages this project. The work is performed by industrial contractors, Department of Defense and educational institutions on contract and in-house. The ten major contractors in FY 1980 were: Boeing Aerospace, Seattle WA; Environmental Research Institute of Michigan, Ann Arbor MI; Systems Control, Inc., Palo Alto CA; Grumman Aerospace Corp., Bethpage NY; the Analytic Sciences Corp., Reading MA; Computer Sciences Corp., Huntsville AL; General Dynamics, Pomona CA; General Research Corp., Santa Barbara CA; Dynetics Corp., Huntsville AL; and the University of Florida, Gainesville FL. There were a total of thirty-five contracts issued in FY 1980 to twenty-five contractors. Of this total, twenty of the contracts were incrementally funded and/or follow-on to FY 1979 and prior year contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Completed a feasibility determination for a millimeter wave target simulator. Conducted a hardware-in-the-loop simulation of the bank-to-turn control concept for advanced guided weapons. Completed the design for the tactical global positioning system antenna for tactical conventional missiles. Successfully validated the round robin, multiplex bus interface unit functional design. Completed design and construction of the radio frequency simulator. Infrared target and background measurements were accomplished in the

Project: #2068

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Guided Weapons Technology & Simulation

Title: Conventional Munitions

Budget Activity: Technology Base, #1

Continental United States on four different occasions to fully characterize seasonal variations. Established a computerized infrared data base. Established computer models of generic millimeter wave terminal guidance seekers. Completed design of a high performance gimbal system for highly maneuverable air-to-air missiles. Awarded a Systems Engineering and Technical Assistance Contract to provide engineering analysis support in the areas of system analysis, laser, radar, infrared sensors/seekers, guidance and control, and inertial guidance. Contractor personnel are in place at Eglin and performing. The Air Force Armament Laboratory Missile Simulation Laboratory was completed and successfully demonstrated. The Extended Kalman Filter Aerodynamic Parameter Identification Algorithm was updated. Completed Air Force validation testing of generic hardware for the Tri-Service Ring Laser Gyro Program. The computer model for airborne millimeter wave passive terminal homing was completed. A preliminary environmental model for predicting the infrared contrast of selected armored targets in natural background was completed. Second generation millimeter wave seekers were analyzed to identify seeker design approaches. Computer models for each of the millimeter wave contrast guidance demonstration seekers and a generic future generation on the Eglin computer and interfacing with the infrared modeling analysis scene generator were completed. The infrared Imaging Seeker/Breadboard Contract was awarded. The Ramjet-Interlaboratory Air-to-Air Technology analysis has been completed. Validation of the Target/Clutter and six degrees of freedom simulations were completed. Millimeter wave and infrared signature measurements of tactical targets in typical European backgrounds were acquired during Aug/Sep 80.

2. (U) FY 1981 Program: Investigate molded plastic inertial sensors for use in tactical weapons. Continue the solid state laser gyro effort. Complete the feasibility determination of the cantilever accelerometer which is based on a unique linear spring concept. Continue emitter homing technology initiative. Investigate different multi-mode seeker concepts for air-to-air missile applications. Begin hardware fabrication based on the complete design of the digital subsystem simulator. Continue to develop lensing techniques for minimizing boresight error slope for broadband radio frequency air-to-air missile radomes. Continue evaluation of a focal plane infrared seeker for air-to-air missile applications. Investigate infrared and millimeter wave signal processing techniques. Continue millimeter wave and infrared target and background signature measurements. Investigate low cost velocity update techniques for tactical weapons. Laboratory test spinel and sapphire infrared air-to-air missile radomes for thermal shock and rain erosion resistance.

3. (U) FY 1982 Planned Program: Continue evaluation of molded inertial sensors for tactical weapons. Complete evaluation of the solid state laser gyro and transition effort to advanced development. Evaluate new emitter homing concepts. Begin checkout and use of the digital subsystem simulator. Continue simulation of advanced missiles. Infrared energy processing devices will be fabricated and mechanically and electrically interfaced with an imaging seeker. Evaluate sensing and actuation. Evaluate digital signal processors that can be used with high-speed array processing for use with infrared and radio frequency sensor data. Investigate infrared air-to-air missile radome to include radome heating tests. Continue advanced control theory investigations and advanced seeker algorithm generation. Continue efforts to solve the adverse weather seeker problem for tactical air-to-air and air-to-surface weapons. Evaluate new aerodynamic control concepts that will provide a capability for enhanced control effectiveness and reduced response time at high altitudes.

Project: #2068

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Guided Weapons Technology & Simulation

Title: Conventional Munitions

Budget Activity: Technology Base, #1

4. (U) FY 1983 Planned Program: The establishment and maintenance of a target and background signature data base to support terminal homing developments in infrared and millimeter wave will be of a continuing nature. Millimeter wave measurements will be limited to data collection to provide a principal operating mode or other techniques necessary to support a specifically promising seeker. Continue infrared measurements to meet requirements of terminal homing seeker program. Continue evolution of synthetic target and background simulation capabilities. Continue emphasis on laser imagery to support seeker programs. Expand basic Infrared Modeling and Analysis systems simulations. Continue to advance the millimeter wave terminal guidance seeker design techniques. Advance the technology in the areas of shutdown and continuous wave target homing in support of defense suppression and counter command, control and communications seeker development. Breadboard and test radio frequency techniques for application to adverse weather direct strike systems. Feasibility breadboards will be fabricated to demonstrate viable radio frequency techniques applicable to the advanced air-to-air seeker problem for application to beyond visual range passive/active all-weather seeker technology. Continue to support investigation of optical predetection processing and electronically steering the laser beam by means of acousto-, electro-, and magneto-optical materials. Incorporate new techniques/devices into seeker hardware to demonstrate performance cost, and efficiency improvements for a combined day/night capability. Accomplish feasibility studies, demonstrations for scene infrared and radiation mode millimeter wave target simulators. Determine and demonstrate via simulations the appropriate optimal control techniques for improving missile performance and determine the subsystem technology requirements which are necessary for successful execution of the optimal control techniques. Continue ongoing efforts to investigate digital hardware and software techniques for application to guided weapons with emphasis on integration, flexibility, maintainability and cost.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	7,862	8,097	8,406	11,304	Continuing	Not Applicable

8. (U) Comparison with FY 1980 Budget Data: (\$ in thousands)

RD&E	7,862	6,600	9,700	Continuing	Not Applicable

Additional funds added to this project are to increase emphasis in emitter homing seeker concepts, strapdown seeker, midcourse weapon technologies, and development of a simulation capability for evaluating digital subsystems in weapons.

Project: #2502

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Munitions, Dispensers & Component Technology

Title: Conventional Munitions

Budget Activity: Technology Base, #1

tests with two sizes of warheads have been completed, and consistent sustained fires against real trucks have been achieved. The Low Level Queued Dispenser Technology contract, the Selectable Linear/Area Pattern Control Contract, the Bunkered Target Munition contract and the Dynamic Interface Simulation of Clustered Ordnance contract were awarded. Warhead designs have been accomplished using data from the depleted uranium and selected alloy study. Significant progress has been made on the identification of viable defeat agents in determining the feasibility of fuel defeat weaponization. The Advanced Fragmentation Warhead contract has been awarded for hydrodynamic code calculations to establish warhead designs. The contract for development of improvements in Baseband Reflectometry Sensor Antenna Technology and Electronic Counter-Countermeasures has been awarded. Completed the effort on the Pyrotechnic Delay Slapper Detonator. Completed a computer program investigating cluster bomblet patterns as a function of spin rate and release velocity; the remote interface unit card was completed, and the computer program written and verified. The target activated munition system algorithm has been finalized and implemented in a brassboard built around the 1804 microprocessor. Brassboard performance tests are in process. The Advanced Target Activated Munition sensor concepts were developed in four categories - passive line-of-sight, passive nonline-of-sight, active and communicating/dispersed Signature data for aircraft and for foreign and U.S. vehicles were collected. A computer simulation of the preliminary design was tested against the taped signature data, which is an important first step in developing an understanding of the target sensing problem.

2. (U) FY 1981 Program: The numerical hydrodynamics (hydrocodes) programs will be modified to improve efficiency of existing design tools as well as expanding capability into workable three dimensional calculations making treatment of penetrator designs under oblique impacts possible. Continue three basic fuze technologies, air-to-air proximity and impact sensors; air-to-surface proximity, impact penetration and void sensors; and warhead and rocket motor safing and arming devices. Continue to develop techniques to harden sensors against electronic countermeasures. Initiate effort to develop sensors capable of measuring the identified critical parameters to parameters, to provide alternatives to seismic and acoustic sensors. Improve sensing techniques and develop models for target signature generation and propagation.

3. (U) FY 1982 Planned Program: Develop and demonstrate the technology for multiple kills per aircraft sortie. Demonstrate devices capable of selectively tailoring submunition patterns to the target configuration (linear or area pattern control). Investigate techniques for reduction of forward velocity of the ejected submunition. Evaluate advance aircraft and cruise missile requirements to provide advanced dispenser technology for cluster munitions. Investigate more efficient safe smoke and screening techniques. Continue to investigate/optimize the combination of self-forging fragmentation technology with integral incendiary to provide effective submunitions for defeat of diesel fuel targets. Formulate and evaluate kinetic energy penetrator concepts and designs for penetration into buried/hardened Command, Control, and Communications facilities. Develop and demonstrate warhead technology to defeat both mobile and fixed

Project: #2502

Program Element: # 62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Munitions, Dispensers and Component Technology

Title: Conventional Munitions

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports design and feasibility demonstrations of advanced air delivered weapons. The objectives are to conceive, develop and demonstrate the feasibility of new cluster munition dispersal systems, containers, and submunitions (including submunition kill mechanisms), fuze, stabilization/retardation devices to provide an increase in performance and lethality of air-delivered munitions. To develop, modify and apply computational techniques for predicting the performance of conventional munitions, primarily through the use of hydrodynamic computer programs (hydrocodes) including capabilities for predicting elastic-plastic and hydrodynamic motion. A cradle-to-grave fuze philosophy has been established. The balanced fuze technology program will address both air-to-air and air-to-surface weapons and provide a technology base for target activated munition sensor and related target signal processing.

(U) RELATED ACTIVITIES: This project supports Conventional Weapons, PE 63601F; Missile Subsystem Technology Integration, PE 63313F; Advanced Medium Range Air-to-Air Missile, PE 63316F; Advanced Aerial Targets Technology, PE 63232F; and Advanced Attack Weapons, PE 63609F. Bomb, Submunition and Dispenser Technology efforts are coordinated through the Joint Service Guidance and Control Committee, and the Joint Technical Coordinating Group under the auspices of the Joint Logistic Commanders and other formal and informal coordinating groups. The objective of coordination between services is to maximize technology output through complementary programs.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin AFB, FL, manages this project. The work is done by industrial contractors, Department of Defense, Department of Energy, and educational institutions on contract and in-house. The ten major contractors in FY 1980 were: Chamberlain Mfg Corp, Waterloo, IA; Honeywell, Inc., Hopkins, MN; Orlando Tech, Inc., Orlando, FL; Aerojet Ord and Mfg Co, Downey, CA; Lockheed, Sunnyvale, CA; General Dynamics, Pomona, CA; Sperry Research, Sudbury, MA; RCA Advanced Comm Lab, Sommerville, NJ; Systems Science and Software, San Diego, CA; and Istron Corp, Canton, MA. There was a total of twenty-seven contracts issued in FY 1980 to twenty-one contractors. Of this total, eighteen of the contracts were incrementally funded and/or follow-on to FY 1979 and prior year contracts.

1. (U) FY 1980 and Prior Accomplishments: Concept studies for a Low Altitude Dispenser were completed and transitioned to Advanced Development. A technology application study was accomplished identifying weapon concepts to destroy hardened command and control targets. Sled tests were completed and successfully demonstrated the feasibility of optimizing submunition effects through controlling the depth of burial. Fuzing efforts identified concepts capable of providing improved warhead burst point control and warhead aiming for directional air target warheads. Extended range antiarmor mine supporting technology was completed and transitioned to system validation. The feasibility of a target activated munition system microsignal processor was demonstrated. Antimaterial Incendiary Submunition demonstration

Project: #2502

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Munitions, Dispensers & Component Technology

Title: Conventional Munitions

Budget Activity: Technology Base, #1

targets of the future. Continue fuze sensor and fuzing system technology currently under development which perform predictably against a variety of targets under environmental extremes as well as hostile countermeasures. Test functional warhead models against realistic targets to establish their performance. Develop very long range, standoff weapons. Develop target signature sensors capable of discriminating live targets and determining target positions. Address the problem of identifying and tracking individual targets in the presence of multiple targets. Develop a central fuze processor which uses information from the guidance system, weapon delivery computer systems, autopilot, etc. and reduces fuze complexity and cost. Develop nonprecision mechanical and/or in-line electronic safing and arming devices with a secure communication link and an aircraft/fuze data interface module. Develop a concept for implementation of avionics integrated fuzing using the F-16 as a baseline.

4. (U) FY 1983 Planned Program: Continue development technology for modular dispenser systems with selectable patterns (linear/area) for guided, unguided and cruise missile applications. Provide a design basis for advanced dispenser technology for cluster munitions, for interaction with advanced aircraft and cruise missile requirements. Continue the warhead technology efforts in the following areas: advanced kill mechanisms; warhead physics/materials properties; penetration dynamics; and warhead conceptualization/demonstration. Continue the development of fuzes, sensors, and fuzing systems which perform predictably against a wide variety of targets under environmental extremes as well as hostile countermeasures. Complete the fuze sensor technology necessary to build a 99 percent reliable air-to-surface fuze system for impact, impact time delayed, and proximity functioning for demonstration in FY 1984. Accomplish extensive field testing on the breadboard sensor addressing the problem of identifying and tracking individual targets in the presence of multiple targets and clutter. Provide designs for two basic safing and arming devices for all air-delivered weapons; one for powered weapons and one for unpowered weapons. Demonstrate the feasibility of the standardized avionics integrated fuze subsystem design using one or more of the following aircraft, F-4, A-10, F-16, or F-18. Continue ongoing efforts to enhance the survivability, weapons effects, flexibility, response time, reliability, weight reduction, and accuracy.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Addition to Completion Costs	Total Estimated Costs
RD&E	4,954	4,500	5,300	6,900	Continuing	Not Applicable

Project: #2502

Program Element: #62602F

DOD Mission Area: Engineering Technology (ED), #523

Title: Munitions, Dispensers & Component Technology

Title: Conventional Munitions

Budget Activity: Technology Base, #1

8. (U) Comparison with FY 1981 Budget Data (\$ in thousands):

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>Additional</u>	<u>Total Estimated</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Costs</u>
RDT&E	4,027	4,800	4,900	Continuing	Not Applicable

(U) Additional funds added to this project are to increase emphasis on avionics integrated fuzing, destroying buried command, control, and communication targets, advanced warhead technology and development of fuzes, sensors, and fuzing systems which perform predictably against a variety of targets as well as hostile countermeasures.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) RESOURCES (PROJECT LISTING) (\$ in thousands) :

Project Number	Title	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
	TOTAL FOR PROGRAM ELEMENT	57,935	61,300	67,999	83,029	Continuing		
06DM	Laboratory Operations	26,543	26,800*	27,316	27,700			
2338	Assurance Techniques for Electronics	4,772	4,800	5,725	8,200			
4506	Surveillance Technology	6,473	6,700	7,558	10,300			
4519	Communications & Control Technology	5,811	5,500	6,725	9,500			
4594	Intelligence Technology	5,332	5,500	6,725	9,329			
4600	Electromagnetic Radiation, Devices & Components	4,764	5,500	6,425	8,600			
5581	Information Sciences Technology	4,240	6,500	7,525	9,400			

* Excludes Oct 1980 Civilian Pay Raise

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides a broad technology base for advancing Air Force mission capabilities in Command, Control and Communications (C³), a mission requirement which is rapidly increasing its significance because revolutionary advances in electronics permeate C³ technology, offering more unique opportunities than in any other mission areas to cope with the crucial time compression of modern warfare. Six basic technology areas are pursued: Surveillance; Intelligence; Communications and Control; Information Sciences; Electronic Reliability and Electromagnetic Compatibility; and Electromagnetic Radiation, Devices and Components. The program element also provides for the operation of the Rome Air Development Center (RADC), Griffiss AFB, Rome NY, and the RADC Deputy for Electronic Technology, Hanscom AFB, Bedford, MA.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The information gathering and data processing explosion spawned by revolutionary advances in semiconductors in the last decade could saturate the typical tactical Commander. He cannot cope with the combined effects of computer driven raw information which is his to exploit coupled with the instantaneous environment of modern weapon systems. We can significantly lessen the commander's decision making task by using computers to do certain data manipulations, analysis and other tasks in which computers are superior to humans. FY 1982 growth funds will be applied to critical intelligence, decision theory, and computer logic technologies for developing decision aids for the command decision process. Other efforts will include reliability certification of microcomputers on a chip for use in military systems. Limited ground testing of a ten foot by ten foot membrane phased array antenna for spaceborne radar technology will be completed. Standardized fiber optics components suitable for tactical usage will be developed for transition to advanced development. Exploitation of a new radiation resistant semiconductor junction will continue.

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	54,416	63,200	69,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Military Construction

1,200

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Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: The technical explosion in electronics in recent years is making a profound impact on Air Force Command, Control and Communications technology at the exploratory development level, perhaps more so than in any other mission area. Although advances in electronic devices provide unique opportunities for revolutionary advances they have attendant problems peculiar to military environments not experienced by, nor of concern to, the commercial sector. The introduction of very large scale integrated circuits will provide densities of hundreds of thousands of transistors on a chip with millions of instructions per second, basically placing the equivalent of large computers on a single chip. Utilization of these "systems" on a chip in military equipment demands determination of their reliability over the range of military requirements. That demands totally new technologies because it is not possible to get inside these "systems" which in the past were combinations of thousands of individual chips to which probes could be attached. One new method this program has produced is the invention of a visual post mortem technique used on large integrated circuits by viewing them through a liquid crystal which reveals failure points within the circuit. This and special electron microscope methods are the kinds of tools being provided to maintain integrity of military reliability in systems using integrated circuits. Surveillance technology faces unique challenges being addressed in this program. How do you positively identify a target aircraft beyond visual range as friend or foe, since even if it is an American made fighter it could be under operation by a non-friendly, i.e., an Iranian F-14? This program is pursuing non-cooperative target recognition techniques to attack this problem. How do you put a radar in space which is jam resistant, capable of detecting extremely small targets and has an antenna perhaps the size of a football field? This program element is providing the low power, low cost, transmit/receive modules, signal processing, and membrane antenna technology to solve these problems. It is also providing the technology to detect and track extremely low radar cross section, stealthy targets such as high speed, low altitude cruise missiles which conventional radars cannot "see". In communications, as in device technology, the Air Force is capitalizing on commercial sector advances and adapting them for specific military problems as in fiber optics advances. The Air Force Tactical forces, for instance, can profit greatly from this technology but require capabilities which the commercial telephone companies do not. The telephone applications are basically installed, undisturbed, in a benign environment and are not subjected to numerous set up-tear down sequences, field splicing, nuclear radiations, and rugged abuses of a tactical deployment. However, this program is providing the technology to solve these problems and to standardize components for lower costs. The payoffs are tremendous because transmission distances can be increased by a 20 to one ratio over copper cable with a 10 to one weight advantage, increasing tactical survivability and airlift capability. For instance, radio frequency emitters in a tactical deployment can be located miles from control vans as opposed to hundreds of feet and the ten C-130s (or equivalent) required to airlift the copper cable for a single Tactical Air Control System can be reduced to one C-130. The advances in computing and electronics technologies have also produced a glut of information gatherings and handling. Intelligence requirements to keep up with information processing and to optimize exploitation has driven technology to pursue methods of high density recording and extremely high speed data access and retrieval. Conservative estimates place the size of the various Air Force data depositories at between 10^{14} and 10^{16} bits, the equivalent of 27 million rolls of computer compatible magnetic-tape. Of that, 10^{13} is required to be on-line and accessible in under five seconds, an obvious impossibility for computer tape stations. As a major step in solving this problem, this program element has developed wide band recording in high density digital recorders and data transfer rates of 600 million bits per second. For instance, a laser recorded digital optical disc the size of a phonograph record has been developed which can store 10^{11} bits as a single disc, the equivalent of the complete Encyclopaedia Britannica in digital form. A 100 disc "juke box" configuration is being developed to provide 10^{13} bits of storage accessible at megabit transfer rates (for comparison, the human brain is estimated at 10^{15}

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

bit capability). Advanced data handling capacities such as these and other developments of modern warfare have far outstripped our capability to manage it effectively. The speed, power and sophistication of modern weapons and the political and geographical complexities of the battlefield have placed today's tactical commander in a data rich environment that overwhelms his abilities to accurately respond in time-critical decision situations. This program is providing technology to determine which decisions within a modern tactical Command and Control system could be assisted by the use of intelligent decision aids, drawing on the advance technology areas of Artificial Intelligence, Computer Science, and Decision Analysis. These are a few of the many problems and the technologies to solve them being addressed in this program.

(U) RELATED ACTIVITIES: This program is actively coordinated at tri-service and interagency levels to preclude duplication and to meet overall Department of Defense (DOD) needs. Examples of this coordination are the DOD Advisory Group on Electron Devices, the Interservice Antenna Group, the Technology Coordinating Paper on Electronics, the DOD Higher Order Language Working group, and the DOD Software Technology Panel. Participation in various North Atlantic Treaty Organization (NATO) panels and working groups and liaison with the European Office of Advanced Research and Development further coordinates program efforts. Work performed is related to electronics efforts at the Air Force Avionics Laboratory, Air Force Weapons Laboratory, Lincoln Laboratory, the Army Electronics Command, Office of Naval Research, National Aeronautics and Space Administration, the Defense Advanced Research Projects Agency and other government agencies. Image exploitation programs are coordinated through a national committee while the Defense Mapping Agency (DMA) coordinates all service programs in targeting and charting. The National Security Agency coordinates all service programs in signals intelligence and the Defense Intelligence Agency coordinates all work in intelligence data handling. Basic research in Program Element 61101F, Defense Research Science, directly feeds into this program. Major advanced development programs assigned to RADC to which direct technology transfers made are: PE 63728F, Advanced Computer Technology; PE 63750F, Counter-Countermeasure Advance Development; PE 63789F, Command, Control and Communications Advanced Development; PE 63747F, PAVE MOVER. Successful efforts in this program are also transitioned into other program elements such as PE 63208F, Reconnaissance Sensors/Processing Techniques, PE 63431F, Advanced Space Communications; PE 31011G(F), Cryptological Activities; PE 31022F, Scientific and Technical Intelligence; PE 31025F, Intelligence Data Handling Systems; PE 63701B, Mapping and Charting; and PE 64750F, Intelligence Equipment. Related non-Air Force programs are: PE 62725A, Computer and Information Sciences; PE 62705A, Electronics and Electronic Devices; PE 62712N, Surface/Aerospace Target Surveillance; PE 62721N, Command and Control Technology; and PE 62762N, Electronic Device Technology. Technical support is provided to the Electronics System Division, Space Division and to many other Air Force organizations too numerous to list. Support is provided to many DOD agencies including Defense Mapping Agency (DMA), Defense Intelligence Agency (DIA), Defense Communications Agency (DCA), Defense Nuclear Agency (DNA), as well as the Army and Navy.

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Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center (RADC), Griffiss AFB NY, at the RADC Deputy for Electronic Technology, Hanscom AFB MA, and at ten off-base sites located throughout New York and Massachusetts. Ten major contractors in FY 1980 were: Pattern Analysis Recognition Inc., Rome NY; Harris Corporation, Melbourne FL; Syracuse University, Syracuse NY; Hughes Aircraft, Culver City CA; BDM, McLean VA; Honeywell Infosystems, VA; Varian Associates Inc., Palo Alto CA; Syracuse Research Corp., Syracuse NY; General Electric Co., Pittsfield MA; Atlantic Research Corp., Alexandria VA. There were 173 contractors with 362 contracts in FY 80.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Reliability assurance to qualify various integrated circuits for military use has been completed including complex chips consisting of 12,000 gates. A ten foot by ten foot section phased array radiating membrane has been designed, fabricated, and is undergoing testing as a precursor design for spaceborne radar applications. A fiber optic cable to replace the 26 pair copper cables used in Tactical Air Control Systems has been breadboarded (with transmitters and receivers) and has demonstrated that a 20 to one transmission distance improvement and a 10 to one weight advantage can in fact be obtained. High speed wideband recorder development for intelligence processing purposes has produced a digital optical disc which can store the equivalent information of the complete Encyclopedia Britannica on a single phonograph record sized disc. This has been coupled with high rate data manipulation development allowing 320 million bits per second data transfer. This is leading to extremely high density storage and data access capability of 10¹³ bits of storage. A new semiconductor junction, polysilicon/silicon, has been invented and shows promise in reducing the susceptibility of very large scale integrated circuits to radiation. A new computer language tool has been developed that allows specifying and emulating a particular computer hardware configuration before it is actually built, resulting in a significant cost savings.

2. (U) FY 1981 Program: Reliability investigations are focusing on emerging single chip microcomputers and high density solid state memories. The radiating membrane for spaceborne radar applications is being fitted with a limited number of power modules and phase shifters to conduct initial testing including the capability to fold and unfold the structure. A new effort will begin to examine candidate computer architecture required to optimize the capabilities presented by emerging very high throughput devices. Investigations are continuing on a new mode of propagating very low frequency signals that could result in significant reductions in the length required for aircraft trailing wire antennas. Development is continuing on the new radiation resistant junction technology for use in very large scale integrated circuits. Development will continue on the compiler for the new Department of Defense higher order computer language called ADA. Design is being completed on a series of high performance fiber optics transceivers capable of ruggedized military application.

3. (U) FY 1982 Planned Program: Device reliability improvements will continue for very large scale integrated circuits addressing devices as complex as the 32 bit microcomputer on a chip. Reliability techniques will be applied to the developing Department of Defense Very High Speed Integrated Circuit program. A power distribution subsystem will be added to the radiating membrane for spaceborne radar and limited ground testing will be done. Fiber optic transceivers, multiplexers, and fiber splicing techniques will be integrated and prepared for transition into advanced development in FY 1983. The breadboard model of a 600 million bit per second data rate magnetic recorder will be completed and will

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Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

start laboratory testing. Efforts to reduce susceptibility of very large scale integrated circuits will continue with specific Cosmic ray radiation effects investigations. Emphasis begun in FY 1981 and continuing for five years in computer technology will focus on distributed processing technology for systems survivability and on automated computer programming via Artificial Intelligence Techniques. Real growth funds will be used to attack the area of decision aids, specifically for the tactical commander. Capitalizing on extensive work done in basic research and in the private sector, ways will be found for optimizing computer tools available to help decision makers reduce data, gain real time flexible information handling, and interact with a volatile tactical environment in making critical decisions. Artificial Intelligence methods and decision theory tools will be applied to real world problems in a laboratory environment, leading eventually to active participation of actual tactical commanders via man-in-the-loop technology development. The goal is to provide these commanders with tools derived from emergent advances in computing power for use against the mounting threat of overwhelming information generated by these same advances in computing power, a problem complicated by the instantaneous nature of modern weapon systems technology.

4. (U) FY 1983 Planned Program: Reliability evaluations of electronic devices will include 60,000 gate complexity, very large scale integrated circuits. Improvements in automated decisions will see experimental employment of automated tools in the operational environment and measurements on the possible improvements over present manual operations. Optical digital disc and the 600 million bit per second data transfer capability combined in a breadboard model will be evaluated in an operational environment. Fiber optics cable replacement for the Tactical Air Control System and standardized component development will transition to advanced development. Spaceborne radar technology development will see procurement of a larger number of transmit/receive modules to be tested in a larger section of radiating phased array membrane. Radiation hardening of very large scale integrated circuits will continue with exploitation of new radiation resistant semiconductor junctions.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

(198)

Project: #06DM

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Laboratory Operations

Title: Command, Control & Communications

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the support activities required to operate the Rome Air Development Center (RADC), Griffiss AFB NY, and the RADC Deputy for Electronic Technology, Hanscom AFB MA. Support provided includes the pay and related costs of civilian scientists, engineers and supporting personnel, travel, transportation, rents, communications, utility costs, procurement of supplies and equipment, and contractor support services. RADC is responsible for exploratory development and assigned advanced development programs in surveillance, communications and control, intelligence, information sciences, electronic reliability, electromagnetic compatibility, electromagnetic radiation, devices and components. It is also assigned technology intensive engineering development programs, primarily in the intelligence area. RADC also provides technical support to current and future systems programs.

(U) RELATED ACTIVITIES: The project supports and complements all the technical projects under this program element and numerous other programs being performed at the Rome Air Development Center.

(U) WORK PERFORMED BY: The Rome Air Development Center, Griffiss AFB NY, is responsible for the management of the projects under this element. Work is performed by that organization and the RADC Deputy for Electronic Technology, Hanscom AFB MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) Accomplishments and Future Programs: Plans and accomplishments were discussed in the Descriptive Summary for the overall Program Element included in this submission. This project will also provide for upgrade of the administrative processing support systems needed to support and reduce the workload of the laboratory contract managers. This is an experiment in office automation and management information systems scheduled for completion in 1982.

2. (U) Program to Completion: This is a continuing program.

3. (U) Milestones: Not Applicable.

4. (U) Resources:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
		Estimate	Estimate	Estimate	to Completion	Estimated
					Costs	Costs
RDT&E	26,543	26,800	27,316	27,700	Continuing	Not Applicable

Project: #06DM

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Laboratory Operations

Title: Command, Control & Communications
Budget Activity: Technology Base, #1

5. (U) Comparison With FY 1981 Budget Data: Proj #06DM Laboratory Operations

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E Funds	25,132	26,800	27,200		Continuing	Not Applicable

(200)

Project #2338

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Assurance Techniques for Electronics

Title: Command, Control & Communications

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the Air Force with basic technology in reliability and maintainability (R&M) techniques and in electromagnetic compatibility (EMC). The technologies are staples in terms of Air Force systems dependent on electronics and have assumed paramount importance with the advent of new electronic components such as large scale integrated circuits (LSI). Although one of the chief payoffs is lower systems life cycle costs, the critical factor is systems availability - having the electronics there when needed. The boom of new semiconductor technologies in the last decade has dramatically increased the capability of military electronic systems and has demanded an increased emphasis in ensuring that only those devices qualified to perform over the full range of military stress environments are used in military designs. These devices with their attendant advantages of thousands of gates in a single chip also present unique reliability problems. Functions previously assigned to be implemented by hundreds of discrete chips to which measurement probes could be attached are now integrated into "systems" as a single chip. New evaluation techniques for failure modes and prediction techniques are being developed to keep abreast of these changes. Likewise, in terms of electromagnetic compatibility, the art of preventing systems from interfering electromagnetically with one another has become increasingly difficult with the increased use of LSI devices. These lower powered, densely packed components allow the integration of many more radio frequency emitters in any given platform, but also present unique problems in ensuring that they can function without interference. Not only are these devices susceptible themselves but prediction of their combined effects requires sophisticated techniques beyond those required in the vacuum tube era. The lessons learned in these technologies are transitioned directly to users by the preparation of various military specifications and standards.

(U) RELATED ACTIVITIES: R&M and EMC efforts related to electronic devices are coordinated through the DOD Advisory Group on Electron Devices and Technology Coordination Paper on Electronics. In addition, tri-service panels, and working groups meet on a regularly scheduled basis to discuss and coordinate activities. All of these insure that technology development programs meet military service needs and avoid unnecessary duplication. The work undertaken in this project is related to on-going activities at the Air Force Avionics Laboratory, Lincoln Laboratory, Army Electronics Command, and Office of Naval Research. RADC is a major participant in the DOD Very High Speed Integrated Circuit (VHSIC) program. R&M basic research in PE 61102F, Defense Research Science, transitions into this project. The project output transitions directly into various DOD R&M specifications for which RADC is the preparing activity and both R&M and EMC technology is taken directly to system developers through vigorous system technical support activities. The EMC technology also supports the Intrastem Analysis Program, a sophisticated computerized prediction tool, used to design new weapon systems to be free of electromagnetic interference effects.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center, Griffiss AFB NY. Ten major contractors in FY 1980 were: Hughes Aircraft Co., Culver City, CA; IBM, Manassas, VA; IITRI, Chicago, IL; General Electric Co., Pittsfield, MA; McDonald Douglas, St. Louis, MO; E-Systems, St. Petersburg, FL; Magnavox, Ft. Wayne, IN; Sanders Associates, Nashua, NH; Rockwell International, Cedar Rapids, IA; General Atronics, Philadelphia, PA. There were sixteen (16) contractors with twenty-nine (29) contracts in FY 1980.

Project #2338

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Assurance Techniques for Electronics

Title: Command, Control & Communications

Budget Activity: Technology Base, #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A broad spectrum of product evaluation, electrical characterization and reliability assurance evaluations were completed on Large Scale Integrated Circuits (LSICs) thereby providing highly reliable standardized military solid state devices at the 12,000 gate level of complexity for use in high performance electronic systems. Electron beam analysis and electrical test techniques were developed to assure the reliability of complex devices. The electromagnetic compatibility (EMC) program provided techniques for measuring and mapping the electromagnetic energy distribution within weapon systems. This technique along with the study of radio frequency interference effects in solid state amplifiers will permit design improvements in future electronic systems. Finally, EMC control techniques were developed for interference cancellation of signals originating in high power frequency transmitters. This will result in improved compatibility of high sensitivity receivers.
2. (U) FY 1981 Program: Solid state device programs are being pursued to provide detailed microscopic level electrical, mechanical and chemical information which will result in improved part level reliability. Particular attention is being given to single chip microcomputers and high density solid state memory technology common to both Very Large Scale Integrated Circuits (VLSIC) and the emerging DOD Very High Speed Integrated Circuit (VHSIC) Program. The fault detection/fault isolation capabilities of USAF electronic systems will be improved via development of design concepts for testability. Electromagnetic compatibility (EMC) control activities will concentrate on the development of advanced electronically tuneable resonator technology and reduction of antenna coupler nonlinear interference. These efforts will result in improved transmitter/receiver colocation on command, control, communication platforms.
3. (U) FY 1982 Planned Program: Device reliability programs will continue in VLSIC technology areas along with development of test and fault isolation techniques for devices as complex as the 32 bit microcomputer chip. Activities in this project will directly interface with other programs involving the testability and reliable design of VHSIC devices. A reliability design handbook will be issued to expedite use of the R&M design and test techniques in Air Force systems. EMC prediction and control technology programs will result in the development of design guidelines for improved EMC performance of solid state based electronic systems. Using increased funds, special emphasis will be placed on cancellation of interference across broad bandwidths.
4. (U) FY 1983 Planned Program: Device reliability studies will result in the evaluation of 60,000 gate VLSICs. Technology will be provided for the design of testable digital and analog solid state subsystems. Quality and reliability assurance procedures for this level of system sophistication will also be developed. System-level R&M programs will be developed for application to new advanced development initiatives with emphasis on computer aided design algorithms for testability. Ground and airborne tests will be conducted on advanced EMC synthesizer and high frequency antenna coupler systems.

Project #2338

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Assurance Techniques for Electronics

Title: Command, Control & Communications

Budget Activity: Technology Base, #1

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980	FY 1981 <u>Estimate</u>	FY 1982 <u>Estimate</u>	FY 1983 <u>Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E	4,772	4,800	5,725	8,200	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	4,600	5,200	6,000
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203

172

Project #4506

Program Element: #62702F

Title: Surveillance Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

DOD Mission Area: Electronic and Physical Sciences (ED), #521

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop advanced ground, airborne, and space based system and sensor concepts and the associated technology base for application to future Air Force surveillance needs. The major thrusts include development of new surveillance radar, Electronic Counter-Countermeasures, identification, and survivability technologies for both Tactical and Strategic surveillance. Beyond visual range positive identification is a high priority operational requirement and new technologies are being pursued to solve this problem. New technology is also addressing the problem of detecting and tracking low observable threats, such as cruise missiles. The radar cross sections of these vehicles are so small that conventional radars cannot reliably detect them. Jam resistant, long lived space based radar with the capability to detect and track 1990's type threats is based on the signal processing and array antenna techniques in this project. Space systems and mobile tactical systems require extremely high power tubes and that technology is also developed in this project.

(U) RELATED ACTIVITIES: Electron tube and device developments are coordinated through the DOD Advisory Group of Electron Devices and Technology Coordination Papers on Electronics. In addition, triservice panels and working groups such as the Noncooperative Target Recognition Working Group meet on a regularly scheduled basis to discuss and coordinate activities. For example, a conference on Noncooperative Target Recognition was held in June 80. The work undertaken in this project is related to on-going activities at the Air Force Wright Aeronautical Laboratories, Space Division Electronic Systems Division, Lincoln Laboratory, Army Electronics Command, Office of Naval Research, NASA, and Defense Advanced Research Projects Agency (DARPA). The electro-optical area builds extensively on technology developments sponsored by the Defense Advanced Research Projects Agency. The technology output of the Surveillance Technology project is transitioned into PE 63750F, Counter-Counter measures Development, and PE 63789F, Command, Control and Communication Advanced Development.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center, Griffiss AFB NY. There were 27 contractors working on 74 contracts in FY 80. The ten major contractors were: General Electric Co, Syracuse NY; Grumman Aerospace, Bethpage NY; Raytheon, Sudbury MA; Varian Associates, Palo Alto; Hughes Aircraft Corporation, Torrance CA; Westinghouse Electronics, Baltimore MD; Hazetone, Greenlawn NY; Adaptive Optics Assoc., Cambridge, MA; Descision Science Applications, Arlington, VA; Spectra Research Systems, Irvine CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The feasibility of using unintentional and/or mission related electromagnetic emanations from targets to augment ground radars for target identification has been established. An automatic classification algorithm which uses wide bandwidth radar data to positively identify target aircraft has been demonstrated. A data handling concept for regional integration of aircraft identification data has been generated which has the potential for a breakthrough in target identification. A high confidence detection/discrimination technique using various sensor technologies for nullifying cruise missile penetration has been found. An experimental traveling wave tube was demonstrated which has twice

Project #4506

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Surveillance Technology

Title: Command, Control and Communication

Budget Activity: Technology Base, #1

the previous available peak microwave power over octave (2 GHz - 4GHz) bandwidth, a significant capability advance against jamming that offers at least a two to one reduction in cost to manufacture over conventional traveling wave tubes. A 10 foot x 10 foot section of a phased array radiating membrane such as needed for a spaceborne radar has been fabricated and is now undergoing structural and dynamic tests. Lightweight transmit/receive module components and phase shifters for use in the radiating membrane were fabricated and exceeded power and weight goals.

2. (U) FY 1981 Program: Integration requirements are being defined for interfacing cruise missile detection sensor candidates into existing Air Force surveillance networks to provide expanded low level coverage. Radar signature data is being collected to provide both a real world data base for subsequent system evaluation of promising surveillance concepts and evaluation of discrimination techniques between cruise missile and false targets. Transmit/receive module development is continuing for spaceborne and ground tactical radars with high potential payoff for providing cost effective survivable radar performance. The phased array radiating membrane is being populated with a limited number of phase shift modules and testing is commencing. Work will begin on deployment evaluation of a membrane through a series of wrap/unwrap tests. Detailed point designs for low altitude strategic surveillance systems will be completed. Preliminary candidate Advanced Airborne Surveillance Radar (AASR) configurations are being established. This radar technology will be available to the next generation Airborne Warning and Control System.

3. (U) FY 1982 Planned Program: The strawman system design for the AASR will be developed and emphasis will be added to investigate identification techniques for this specific type of radar. An alternate radiating membrane for spaceborne radar applications using phase shift only will be tested as a variant to the original concept. A membrane power distribution subsystem will be developed and evaluated. Cruise missile surveillance technology, which was to transition to advanced development in Fiscal Year 1982, has been delayed for lack of advanced development funds. Work will continue in Fiscal Year 1982 to refine and optimize the sensor models against enemy mission scenarios. Demonstration of identification techniques and correlation of the data will validate this method of determining identity of unknown aircraft. Efforts to incorporate decision aids (automated tools) in this correlation and decision process will begin. Funds growth will be used on increased cruise missile surveillance technology efforts.

4. (U) FY 1983 Planned Program: Experimental verification of the technologies identified in the AASR strawman will begin. Large quantities of transmit/receive modules will be procured using growth funds to purchase both the primary and alternate membrane requirements. These modules will be freely tested in a phased array membrane. Deployment and power distribution tests will continue. Cruise missile surveillance efforts will begin transition to advanced development. Efforts to enhance target identification by incorporating intelligence inputs into the data correlation process will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project #4506

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences (ED), #521

Title: Surveillance Technology

Title: Command, Control and Communication

Budget Activity: Technology Base, #1

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RDT&E	6,473	6,700	7,558	10,300	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	5,600	6,600	7,800	Continuing	Not Applicable
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(206)

Project: #4519

Program Element: #62702F

DOD Mission Area: Electronic and Physical Science

(ED), #521

Title: Communications and Control Technology

Title: Command, Control and Communication

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project addresses communications needs ranging from very low frequencies to optical frequencies. It develops technology for increasing communications data rates, survivability and flexibility, and addresses techniques for locating and identifying enemy emitters. Recent operational experience reinforces the fact that in a typical hostile engagement the radio frequency spectrum will be flooded with both friendly and hostile, intentional and unintentional signals. This project provides the technology to locate and identify those signals to be fed to an Air Force offensive capability i.e., a Command Control and Communications Countermeasure force which can then take appropriate countering action against enemy Command, Control and Communications. Another example of important technology is in the area of adaptive high frequency communications. The high frequency portion of the energy spectrum is receiving increased attention after a period of long neglect. Adaptive techniques take the "chance" out of high frequency communications connectivity between users, making it a more reliable path. Technology to provide secure voice and data over adaptive high frequency paths is developed in this project. Another example of high payoff technology in this project is in fiber optics technology, especially for tactical users. Although this technology is maturing in the commercial world, the Air Force has specific problems unique to the military world which the telephone companies do not have. The requirements for many tear down and set up sequences which the Air Force demands in using film optics in a tactical environment between combat shelters, and the requirement for quick, reliable splicing and are just two examples of problems which are being addressed. The payoffs are increased bandwidth, 10 to one savings in deployment weight and a 20 to one increase in transmission distance.

(U) RELATED ACTIVITIES: The work undertaken in this project is related to on-going activities at the Air Force Avionics Laboratory, Lincoln Laboratory, Office of Naval Research, NASA, Defense Advanced Research Projects Agency, the Army Satellite Communications Agency and the Defense Communications Agency. Tri-service working groups and panels, such as the Fiber Optics Coordinating Group, meet to discuss and coordinate activities. Internal Air Force coordination is accomplished at all levels of management to eliminate duplication. The technology output of the Communications and Control Project is transitioned into PE 63789F, Command, Control and Communications Advanced Development and PE 33126F, Long Haul Communications.

(U) WORK PERFORMED BY: The in-house activity is performed at the Rome Air Development Center, Griffiss AFB NY, at the Deputy for Electronic Technology, Hanscom AFB MA and at small off-base sites in New York state. The ten major contractors in 1980 were: Hughes Aircraft, Fullerton, CA; Harris Corporation, Melbourne, FL; Pattern Analysis Recognition, Rome, NY; Hazeltine Corporation, Greenlawn, NY; Ohio State University Research Foundation, Columbus, OH; CNR Corporation, Upper Falls, MA; IBM Corporation, Owego, NY; GTEsylvania, Needham Heights, MA; Ball Brothers Research Corporation, Boulder, CO; Signatron Corporation, Lexington, MA. There were 15 contractors with 51 contracts in 1980.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The first demonstration of successful emitter location (regardless of type of modulation) and identification techniques in an operational environment was conducted in Europe to establish the technical foundation for future use of these techniques in Command, Control and Communications Countermeasures applications. Field

Project: #4519

Program Element: #62702F

DOD Mission Area: Electronic and Physical Science
(ED), #521

Title: Communications and Control Technology

Title: Command, Control and Communication

Budget Activity: Technology Base, #1

use of an experimental 26 pair fiber optic cable demonstrated a 20 to one improvement in transmission distance with a 10 to one savings in deployed equipment weight over copper cabling in a Tactical Air Control System. Guidelines for fiber optic components have been developed and are being published. A cost effective interconnect control signal system for the planned advanced development model of the Flexible Intraconnect program was designed and fully evaluated in the communication system laboratory facility to decrease the technical risk. The Flexible Intraconnect will be a general purpose bus for information transmission in the tactical arena. A baseline network design was completed and initial equipments were installed in preparation for the interconnection of various distributed laboratory facilities which will comprise the command and control laboratory of the future.

2. (U) FY 1981 Program: An improvement program has begun to upgrade the Coherent Emitter Location System to provide improved performance in the Command, Control and Communications Countermeasures mode during follow-on flight testing on Continental United States and in the European theater. The design for a series of standardized high performance fiber optic transceivers capable of wide application is being completed and work will be initiated on fiber optic multiplex techniques leading to multipoint applications of cost effective systems. Work is being completed on an experimental model of the automatic tropo alignment equipment to permit rapid installation and operational capability of tropo radio links in tactical environments. A program to reduce the cost of terminals will be initiated with a study to identify and prioritize specific technical areas where effective savings can be achieved in the SATCOM equipments to be delivered in Fiscal Year 83 and following. Feasibility models of 3 different high frequency modems employing new techniques to increase accuracy and data throughput in a jamming environment will be tested and evaluated for use in advanced development models.

3. (U) FY 1982 Planned Program: A message mode high frequency processor using a direct sequence technique will be tested in a jamming environment preparatory to construction of advanced development models. An interactive laboratory modeling capability will become operational to allow Computer Aided Design down to the subsystem and equipment level on communications equipment to decrease the lead times to get operational equipment into the field. Fiber optics will see integration of multiplexers, ruggedized cabling, transceivers and splicing techniques being integrated in preparation for planned transition to advanced development in Fiscal Year 1983. Increased emphasis will be placed on adaptive tactical communications.

4. (U) FY 1983 Planned Program: The integrated laboratory facilities comprising the Command and Control laboratory will become operational and large scale evaluation of experimental Command Control systems will be initiated. Fiber optics components for tactical use and adaptive high frequency communications improvements will transition into advanced development.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #4519

Program Element: #62702F

DOD Mission Area: Electronic and Physical Science
(ED), #521

7. (U) Resources:

	FY 1980	FY 1981 Estimated	FY 1982 Estimated	FY 1983 Estimated	Additional to Completion	Total Estimated Costs
						Not Applicable
RD&E	5,811	5,500	6,725	9,500	Continuing	Not Applicable
8. (U) <u>Comparison with 1981 Budget Data:</u>						
RD&E	4,500	5,800	6,900		Continuing	Not Applicable

Title: Communications and Control Technology
Title: Command, Control and Communication
Budget Activity: Technology Base, #1

Project: #4594

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Intelligence Technology

Title: Command, Control and Communication

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the technological advances to improve the extraction of intelligence from a variety of source data. Major thrusts include the development and application of advanced recording and data handling technology to insure the accurate and timely collection, processing, storage, presentation and dissemination of extremely high data rate intelligence information for decision making. Improved methods and equipments are developed for exploiting tactical and strategic reconnaissance images in the timely and accurate location of targets. Basic techniques are developed for the Defense Mapping Agency to allow them to accelerate the production of digitized terrain data around the world.

(U) RELATED ACTIVITIES: Imagery exploitation programs are coordinated through the National Exploitation Committee, while the Defense Mapping Agency coordinates all service programs in mapping and charting. The National Security Agency coordinates all service programs in signal intelligence and the Defense Intelligence Agency coordinates all work in data handling. All of the preceding insures that intelligence technology development within the services is not unnecessarily duplicated. The technology output of the Intelligence Technology project is transitioned into PE 63789F, Command, Control and Communications Advanced Development; PE 63747F, Low Visibility Moving Target Acquisition/Strike; PE 63208F, Reconnaissance Sensors/Processing Techniques; PE 31011G(F), Cryptologic Activities; PE 31022F, Scientific and Technical Intelligence; PE 31025F, Intelligence Data Handling Systems; PE 63701B, Mapping and Charting; and PE 64750F, Intelligence Equipment.

(U) WORK PERFORMED BY: The in-house work is performed at the Rome Air Development Center, Griffiss AFB NY. The ten major contractors for Fiscal Year 1980 were: PAR Incorporated, Rome NY, Measurement Concept Corp, Rome NY; RCA, Camden NJ, Planning Research Corp, McLean VA; Control Data Corporation, Minneapolis MN; Sterling Systems Incorporated, Washington DC; TRW, Redondo Beach CA; Aero Research Associates, Princeton NJ; Synectics Incorporated, Fairfax VA; Analytic Sciences Corporation, Reading MA. There were 44 contractors with 69 contracts in Fiscal Year 1980.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In the signal processing area, the wideband digital disk development was successfully extended to accommodate 320 megabits per second data transfer rates with a bit error rate of 1×10^{-10} . This capability is a first step in developing a 10^{13} bit high density, rapid access storage and retrieval mechanism for advanced Command, Control and Intelligence systems. Each phonograph record sized disc can store the digital equivalent of a complete set of the Encyclopedia Britannica. Non-numeric data handling efforts centered on the development of intelligence analytical methodologies wherein techniques are developed to assist intelligence analysts in estimating events likely to occur next. In imagery exploitation, advances have been made in detecting and identifying concealed/camouflaged targets utilizing thermal infrared imagery. Also, compression schemes, allowing compression ratios up to 30:1 have been developed for transmitting/storing digital image data.

2. (U) FY 1981 Program: Signal processing activity includes the development of a fast start/stop shuttle 600 megabit per second recorder with a capability of recording 66 kilobits per inch for use in real time digital image exploitation. In the optical disc area, real time, usable/re-usable digital disk materials are being evaluated to determine their utility in high resolution digital imagery. In the targeting area, efforts to develop a targeting system independent of a photo data base

Project: #4594

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Intelligence Technology

Title: Command, Control and Communication

Budget Activity: Technology Base, #1

are continuing as are techniques to automatically relate multi-sensor imagery to a point positioning data base in order to derive precise target locations. In the area of intelligence analysis, the utility of sophisticated, mathematical, statistical, and logical techniques in analyzing complex military intelligence problems will be determined. Methods to be considered include time series analysis and multiple/linear regression techniques.

3. (U) FY 1982 Planned Program: The 600 megabit per second computer compatible magnetic recorder breadboard will be completed for test and evaluation. Active data base techniques will be developed wherein prestored intelligence/decision makers goals and algorithms assume responsibility for information flow and control. Such a capability will permit a more complete analysis leading to improved intelligence productivity. Imagery exploitation efforts will focus on future extraction and target detection efforts for automatically identifying changes in strategic targets and detecting known patterns for deploying certain target types. Advances in artificial intelligence and pattern recognition technology will be used to detect and identify targets using funding growth.

4. (U) FY 1983 Planned Program: The reusable disc and 600 megabit per second breadboard recorder systems will be evaluated in an operational environment. Automated techniques will be developed for threat assessment and event analysis based on prior year investigations. Integrated sensor exploitation techniques such as automated target keys to aid the image interpreter in identifying static/mobile targets in real time will be developed and implemented. Advanced image correlation techniques will be developed to correlate digital data bases with near real time down-linked reconnaissance imagery. This will permit accurate ground target location in real time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	
RDT&E	5,332	5,500	6,725	9,329	Continuing		Not Applicable
8. (U) <u>Comparison with 1981 Budget Data:</u>							
RDT&E	4,784	5,800	6,900		Continuing		Not Applicable

Project: #4600

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Electromagnetic Radiation, Devices & Components

Title: Command, Control and Communications

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides the Air Force with a strong technology base and the devices and techniques for exploitation of electromagnetic radiation in command, control and communications (C³), surveillance, and other related systems. The work conducted falls into two broad categories, electromagnetic radiation and transmission technology and solid state device technology. Principal areas of activity are: antennas and radio frequency components, electromagnetic techniques, propagation, electromagnetic materials for C³ applications, advanced solid state devices and circuits, optical and electro-optical devices, and technology for radiation hardening. The antenna, components and propagation technologies attack methods of increasing anti-jam capabilities and survivability aspects of strategic and tactical C³ systems. The fiber optics efforts address very promising techniques for replacing existing cabling systems with low cost, radiation immune, secure, wideband fiber optics links. The electromagnetic materials and devices technologies produce faster, cheaper, much smaller components for such critical missions as tactical radar signal processing. Radiation hardening ensures C³ mission availabilities in spite of nuclear and space environments.

(U) RELATED ACTIVITIES: Efforts related to electronic devices are coordinated through the DOD Advisory Group on Electron Devices and Technology Coordination Paper on Electronics. Antenna efforts are coordinated through the Interservice Antenna Group. Efforts are also coordinated with North Atlantic Treaty Organization nations through participation in international panels. In addition, tri-service panels and working groups meet regularly to discuss and coordinate activities. The work undertaken in this project is related to on-going activities at the Air Force Avionics Laboratory, Air Force Weapons Laboratory, Air Force Materials Laboratory, Lincoln Laboratory, Army Electronics Command, and Office of Naval Research. Basic research in PE 61102F, Defense Research Science, transmissions into this project. Project efforts transition into advanced development programs such as PE 63789F, Command, Control and Communications Advanced Development, PE 63750F, Counter-Countermeasures Advanced Development, and PE 63431F Advanced Space Communications.

(U) WORK PERFORMED BY: The in-house activity is performed at the RADC Deputy for Electronic Technology, Hanscom AFB, MA, and at off base sites in Massachusetts. Ten major contractors in FY 1980 were: Megapulse, Bedford, MA; Rockwell, Anaheim, CA; Anderson Labs, Bloomfield, CT; Texas Instruments, Dallas, TX; Westinghouse, Baltimore, MD; Northeastern University, Boston, MA; Mark Resources, Marina Del Ray, CA; Questron, La Jolla, CA; Proteon, Waltham, MA; Man Labs, Cambridge, MA. There were 51 contractors with 60 contracts in FY 1980.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A new array antenna feed has been designed and fabricated for use in a high power efficiency low sidelobe tactical radar, increasing system survivability. Low power consumption radar switches for unattended radar applications have been demonstrated. An investigation of long wavelength electromagnetic energy interactions with jet engines predicted the presence of usable modulation phenomena for non-cooperative aircraft identification. Intrusion resistant optical fiber communications links were established as potential candidates to transmit sensitive information in clear text. The first long wavelength light sources and detectors were developed for optical transmission through optical fibers. A new type of junction field effect transistor, the Polysilicon Silicon Field Effect transistor (POSFET), was invented.

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Project: #4600 Title: Electromagnetic Radiation, Devices & Components
 Program Element: #62702F Title: Command, Control and Communications
 DOD Mission Area: Electronic and Physical Sciences Budget Activity: Technology Base, #1
 (ED), #521

2. (U) FY 1981 Program: A prospective design for a spaceborne radar antenna is being experimentally evaluated to improve null steering for resistance to jamming. A three pronged approach for improving airborne Satellite Communications antennas will progress with completion of the first phase. An investigation will continue on a new mode of propagating Very Low Frequency signals which could result in significant reduction in the required length of aircraft trailing wire antennas. Intrusion resistant fiber optics will be tested to determine long term stability and environmental factors affecting the fibers.

3. (U) FY 1982 Planned Program: The spaceborne radar antenna nulling evaluation will be completed as scheduled to feed into the overall technology program for this radar. Surface acoustics wave device and Charge-Coupled Device, efforts will result in low cost, light weight signal processors, phase shifters and radio frequency filters. Intrusion resistant fiber optics will be developed in breadboard form. A rapidly deployable low frequency transmitting antenna will be developed. The susceptibility of Very Large Scale Integrated Circuits to Cosmic Ray energy will be determined.

4. (U) FY 83 Planned Program: Antenna efforts will focus on lightweight, high power conformal arrays which can be fitted right into the shape of aircraft skin structures, reducing drag. Technology in antenna feed techniques developed for spaceborne radars will be adapted for possible application in improving ground based radars. Testing on the intrusion resistant fiber optics breadboard will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	4,764	5,500	6,425	8,600	Continuing		
8. (U) <u>Comparison with FY 1981 Budget Data</u> :							
RDT&E	4,600	5,800	6,900	Continuing			Not Applicable

Project: #5581

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Information Sciences Technology

Title: Command, Control & Communications

Budget Activity: Technology Base, #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is the Air Force exploratory development effort which provides technologies to solve generic problems experienced in the acquisition and maintenance of computers and associated software which are embedded in Air Force weapon systems. The primary objective is to reduce the costs associated with all phases of computer resource acquisition and support. The drop in prices of computer hardware have made computers a building block of every major system developed for the Air Force. Developing the software has become the most costly item of computer systems and has been rising per line of instruction delivered because of the increased complexity of the software written and rising labor costs. The thrust of this project, therefore, is to develop those technologies which are needed to evolve software development, acquisition, and maintenance into a controllable, disciplined process. This includes developing automated aids for both managers and designers, mathematically rigorous validation techniques for large programs, computer techniques which allow reuse of proven software, and simplified use of high order languages. In addition to the work in software development, a major new thrust in this project will be initiated to develop automated decision aids based on our on-going investigation of Artificial Intelligence. These thrusts are sorely needed to transition software engineering technology advances to software developers.

(U) RELATED ACTIVITIES: The work performed under this project is reviewed at the DOD level along with other 6.2, 6.3 and 6.4 programs in information processing technology. It supports the DOD Defense Computer Resources Technology Plan. Related non-Air Force programs are PE 62701A, Communications Electronics, PE 62725A, Computer Sciences, PE 62721N, Command and Control Technology, PE 63728F, Advanced Computer Technology and PE 64740F, Computer Resource Management Technology, for demonstration and application.

(U) WORK PERFORMED BY: Major contractors in FY 80 were: Bolt Beranek & Newman Inc., Cambridge MA; Computer Corporation of America, Cambridge MA; General Research Corp., Santa Barbara CA; Harvard University, Cambridge MA; Honeywell Inc., Mclean VA; Northwestern University, Evanston IL; PAR Corp., Rome NY; Stanford University, Stanford CA; Syracuse NY; TRW Inc., Redondo Beach CA; University of Michigan, Ann Arbor MI; University of Southern California, Los Angeles CA; Wayne State University, Detroit MI. There were 13 contractors with 22 contracts in FY 80.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This project has previously provided the standards, tools, and methods which control software acquisition and the tools necessary to standardize and control high order languages in the Air Force. A new hardware description language called SMITE was developed which provides the ability to specify and then emulate a particular hardware configuration before it is actually acquired. Three parallel contracts supporting the DOD high order language program for the development of the Ada Integrated Programming Environment were awarded. A combined hardware/software model was completed in a joint effort with project 2338.

Project: #5581

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Information Sciences Technology
Title: Command, Control & Communications
Budget Activity: Technology Base, #1

2. (U) FY 1981 Program: An evaluation and subsequent enhancement of the existing Software Requirements Engineering Methodology (SREM) will begin. An evaluation of the utility of the MIL STD 1862 architecture (Nebula) to satisfy Air Force requirements will be conducted. The formulation of a plan for a proof of principal Josephson Junction Technology demonstration will begin. The development of the Ada compiler and programming tools will continue. Investigation of potential applications of Automated Command Control (C²) Decision Aids in the tactical environment will be initiated. A new thrust will be undertaken to provide the exploratory development work needed to meet the Air Force computer technology needs for the next twenty years in the areas of distributed processing and software production. These needs are among those identified in the Air Force Systems Command Computer Technology Forecast and Weapon System Impact Study (COMTEC-2000) which contains inputs from government, industry, and the academic sector. Additional funds in FY 1981 through FY 1985 have been programmed in this project above the levels previously planned, specifically to satisfy the needs identified in COMTEC-2000.

3. (U) FY 1982 Planned Program: The development of the Ada compiler and programming environment will continue. A very high level language system will be demonstrated and the use of Artificial Intelligence to support software development will be investigated. The SREM enhancement effort will continue and a candidate acquisition program will be selected for the demonstration of SREM as a methodology to improve software production. Artificial Intelligence in support of decision making will be demonstrated in a selected tactical situation beginning in FY 82. Combined hardware/software models for distributed systems will be initiated and continued through FY 83. The work begun in FY 81 in support of COMTEC-2000 will continue with increased emphasis on automating some portion of the decision making functions in current C² systems.

4. (U) FY 1983 Planned Program: The Ada language and programming environment will be enhanced and work will begin on a retargetable implementation. Artificial Intelligence techniques will be applied to the maintenance of the Ada language. Enhancement of SREM will be completed and will be transitioned to PE 63728F for demonstration on a program selected during FY 82. The SREM effort will be the first major development effort initiated as a result of the COMTEC-2000 Study which will transition to advanced development for demonstration. Development of an automated system to collect quality data on software systems will continue.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

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Project: #5581

Program Element: #62702F

DOD Mission Area: Electronic and Physical Sciences
(ED), #521

Title: Information Sciences Technology
Title: Command, Control & Communications
Budget Activity: Technology Base, #1

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	4,240	6,500	7,525	9,400	Continuing	Not Applicable

8. (U) Comparison with 1981 Budget Data:

RDT&E	5,200	7,200	8,000	Continuing	Not Applicable
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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #62703F

DOD Mission Area: Environmental and Life Sciences (ED) #522

Title: Personnel Utilization Technology
Budget Activity: Technology Base #1

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
06EH	Laboratory Support	4,650	5,100	5,500	7,800	Continuing	Not Applicable
2077	Personnel Management Systems Development	3,571	3,800	4,116	4,227		
7719	Force Acquisition and Distribution System*	86	0	0*	0*		
7734	Force Management System*	619	831	750	1,823		
		374	469	634	1,750		

*Indicates changes from last years submissions. Title of Project 7719 changed from Selection and Classification Technology. Title of Project 7734 changed from Force Structure and Utilization. Project 2077 has been incorporated into Project 7719 and 7734.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The 1980's will see an increasing problem for the Air Force in procuring the quantities and qualities of the men and women required to perform in a high technology work environment. This problem is expected to escalate and adversely impact the Air Force's ability to perform its mission as a result of the continuously decreasing numbers of volunteer-age persons throughout the 1980's. The Air Force manpower problems will continue to seriously impact on mission effectiveness in the areas of pilot and engineer recruitment and retention. This MANPOWER AND PERSONNEL research program addresses the manpower and personnel problems most negatively impacting on the Air Force's ability to perform assigned missions through the planned development of two computer-oriented systems. The Force Acquisition and Distribution System will provide the means for the Air Force to relate knowledge of the national labor market talent pool to the acquisition of the best available talent to man the Air Force. The system will provide, for the first time, a complete integration of Air Force occupational needs, specific individual desires and talents, and detailed and specific job requirements and prerequisites. The Force Management System will provide Air Force management with the information required to integrate recruiting, retention and retraining programs. This system will result in the optimum utilization of available personnel resources through an increased ability to predict turnover, enhance productivity, increase retention, and optimize retraining. Operation and maintenance of the Air Force Human Resources Laboratory, Brooks Air Force Base TX, is partially funded in this program.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program element will fund initial research and development of a Specialized Undergraduate Pilot Training Selection System. This specialized or dual track undergraduate pilot training system will select pilots for the best track, fighter or multi-engine type. Money and time can be saved by sending pilots to either fighter or multi-engine training rather than sending all the pilots to fighter training. It will also fund: development of test devices (psychomotor, reading, and general learning) to select and classify rated and enlisted personnel which

Program Element: #62703F

DOD Mission Area: Environmental and Life Sciences (ED), # 522

Title: Personnel Utilization Technology
Budget Activity: Technology Base #1

will supplement the Armed Services Vocational Aptitude Battery and Air Force Officer Qualifying Test; development of an advanced automated assignment and reassignment system which will provide a list of the best available individuals for each job to the personnel manager, and also a list of the best available jobs to each individual awaiting assignment or reassignment.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	to Completion	Estimated
					Cost	Cost
RDT&E	4,500	5,600	6,200		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #62703F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology

Budget Activity: Technology Base #1

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element contains funding for MANPOWER AND PERSONNEL research in the Air Force. The programs provide the Air Force with a Force Acquisition and Distribution System which will be directed toward new measurement devices, models and procedures designed to improve the personnel system. The program will provide tests for personnel selection and job classification; provide automated systems for collection of perceptual/motor and other data; complete the identification of aptitude, education, experience and physical requirements necessary to perform the jobs in the Air Force; develop person-job-match models; evaluate recruiting resource allocation strategies; integrate and evaluate components into a computer-based personnel management system. The Force Management System will provide for the maintenance of sufficient quantity and quality of personnel, and will capitalize on data automation to assess career motivation and enhance retention potential; to establish a skills management program; to provide career assignment programs and; to evaluate management strategies and options to improve individual productivity and work group effectiveness.

(U) RELATED ACTIVITIES: The Air Force efforts to develop precision selection and classification instruments is oriented around the Armed Services Vocational Aptitude Battery and is primarily guided by a triservice steering committee of general officers. The steering committee met in October 1980 and directed the Air Force Human Resources Laboratory to develop six new forms of the Armed Services Vocational Aptitude Battery. Additional directed activities include extensive standardization, norming, and validation research on the currently operational Battery independently by all services. The Army Military Enlistment Processing Command will be responsible for administering and scoring the battery at the Armed Forces Entrance and Examination Stations as well as for conducting validation research on the form used to test high school students. The computer managed testing program is also guided by a triservice committee which has directed that the Air Force Human Resources Laboratory develop specially calibrated test item pools and conduct research on the unique mathematical models required for adaptive measurement. The Army has been given responsibility for hardware and software development and acquisition, and the Navy, responsibility for determining the most effective methods of adaptive testing and integration of the program for operational use in the Armed Forces Entrance and Examination Stations.

(U) WORK PERFORMED BY: The program is managed by the Air Force Human Resources Laboratory, Brooks Air Force Base TX. Exploratory development is carried out by the Manpower and Personnel Division of the Laboratory. The total contract effort: (\$1,283 thousand) for FY 1980 was conducted by the following contractors or institutions: Research Application, Inc., Potomac MD, CONRAD Research Corp., Pittsburgh PA; Kentron International, Ft. Worth TX; Kinton, Inc., Alexandria VA; McFann, Gray and Associates, Carmel CA; Advanced Research Resources Organization, Washington DC; Applied Science Associates, Inc., Valencia PA; Psych Systems, Inc., Baltimore MD; Psychometrics, Inc., Los Angeles CA; and Technology, Inc., San Antonio TX.

Program Element: #62703F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology
Budget Activity: Technology Base #1

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Significant accomplishments include: the completion of 3 subsystems of the Civilian Appraisal System along with appropriate training packages - The Senior Executive Appraisal System, the Job Performance Appraisal System and the General Manager Appraisal System; the development and operational implementation of six new forms of the Armed Services Vocational Aptitude Battery; a post-enlistment Person-Job-Match algorithm was developed and will be operationally implemented by the Air Force Manpower and Personnel Center in FY 1981; extensive testing and sensitivity analyses, to include the development of five scenarios, have been accomplished on the Integrated Simulation Evaluation Model, the model of the Air Force Manpower and Personnel System; the development of two models to optimize recruiting and advertising efforts; and development survey of technology to identify, define and quantify occupational tasks posing a consequential physical demand for enlisted personnel.

2. (U) FY 1981 Program: The planned research and development efforts will contribute to the completion of the Force Acquisition and Distribution System and the Force Management System as well as being of practical use to the Air Force personnel system in the interim. Techniques to more effectively determine the educational requirements for officer specialties (In particular scientists and engineers) will be completed which will allow a more precise measurement of the needs of officer jobs and thus a better match of available talent to jobs. The implementation of an extensive program to realign enlisted job aptitude requirements is anticipated. This research has been well received by the Air Force Manpower and Personnel Center and will have far reaching implications for Air Force classification policy. Item development of new forms of the Armed Services Vocational Aptitude Battery and the Computer Adaptive Testing program will be conducted. Development and testing of a wide variety of new experimental test measures will be initiated with tests administered to students from Officer Training School, the Air Force Academy, and the Reserve Officer Training Corps as well as Basic Military Trainees. The Recruiting Resources and Goal Allocation model will be exercised under varying accession program and resource constraint limitation scenarios to test and evaluate the model for operational use by Recruiting Service. Efforts will be initiated to enhance the capabilities for addressing real world Air Force Manpower and Personnel problems with the Integrated Simulation Evaluation Model. Criteria will be developed from performance and training settings for use in pilot and navigator selection and classification.

3. (U) FY 1982 Planned Program: The planned research and development efforts include an extensive program for development and validation of cognitive and non-cognitive measures to be used in the selection and assignment of aircrew and line officers. This program will include the collection of data from rated personnel to permit further validation of perceptual/motor tests against Air Force aircrew training and performance criteria. Specialized selection systems will be developed and validated for specialties such as air traffic control, navigators and pilots. The pilot selection research program will include development of a dual track selection program for assignment of students entering pilot training to fighter/attack/reconnaissance aircraft or to tanker/transport/bomber aircraft. Research will be continued to develop and evaluate various techniques for evaluating combat and aircrew job performance and establishing valid performance criteria for use in the validation of operational and experimental selection measures. The above program

Program Element: #62703F

DOD Mission Area: Environmental and Life Sciences (ED), #522

Title: Personnel Utilization Technology

Budget Activity: Technology Base #1

will significantly enhance the Air Force capability to reduce the enormous cost of training rated personnel. Enhancement of the enlisted Person-Job-Match model will include modifications and additions such as a computerized counseling system, a job interest component, a job release scheme, a self corrective forecasting system, the identification and duplication of constraints which affect the first-term airmen initial job location assignment system in a model to allow alternatives for designing austere environment assignment strategies to be investigated, and the initial design of a wartime, scenario oriented, Person-Job-Match model. A prototype Person-Job-Match model for officer personnel will be completed in FY 1982 by coupling officer selection and classification policy software with an initial assignment policy. At the same time, austere recruiting environment assignment strategies will be evaluated and the development of a rated officer contingency selection system initiated. To supplement the above programs to procure and assign the best people for the available Air Force jobs, work will continue on attrition/retention to identify personnel and occupational factors related to the problem and to develop reliable and valid measurement techniques for collecting such information. The final product of this research will be the design of a practical and efficient methodology for incorporating results into the operational selection, classification and assignment system. Research will also be accomplished to determine the factors impacting the reenlistment decision process and models will be developed to provide managers with a feasible reenlistment quota allocation system. Again to supplement the classification and assignment system, research will be initiated to examine the Air Force retraining program and to develop indices estimating the ease with which an airman could be transferred from one career specialty to another. All efforts in this program have a common goal of acquiring and maintaining a viable work force and making the best match possible of people with jobs. The FY 1982 budget of \$6,203 thousand is \$503 thousand above the FY 1981 estimate shown in last year's Descriptive Summary. This increase will be used to develop, refine, and validate performance and training criteria to be used in the selection, classification and assignment of rated personnel and also reflects the civilian pay raise of 1 October 1980 of 9.1%.

4. (U) FY 1983 Planned Program: Planned efforts include the continuation of Department of Defense guided research on the Armed Services Vocational Aptitude Battery and the Computer Adaptive Testing program. Prototype systems will be developed to assess various job performance criteria measures for possible operational use in validating physical and cognitive aptitude requirements. Person-Job-Match modeling will continue with research on officer model development capitalizing on results from research in the enlisted area. Incremental implementation of model components will continue throughout the developmental effort. The recruiting resources and goal allocation model will be expanded and revised for officer recruiting and additional models will be explored for the development of a system for recruiter rewards and incentives. Research in the retraining area will continue with the generation of a matrix of skill and knowledge profiles to develop optimal patterns for reassignments through skills management. The productivity efforts will be focused on an investigation of barriers, especially those under management control, which prevent achievement of optimal productivity and the development of practical mechanisms for improving operations. The enhancement of the Integrated Simulation Evaluation Model will be continued. Research will concentrate on the addition of a rated supplement and refinement of manpower algorithms. Close coordination with Air Force managers will continue to insure scenario realism and to identify ways of improving model validity. Additional efforts will emphasize a more comprehensive model with new capabilities for simulation, a supporting data base, and algorithms for translating the output into information of high utility for decision makers. The increase in funding over the previous year will be used to develop computer-based prototypes for an advanced enlisted reassignment subsystem, a retention management subsystem and for initial prototype development of the Enlisted Force Acquisition and Distribution System.

5. (U) Program to Completion: This is a continuing program.

Program Element: #62703F

DOD Mission Area: Environmental and Life Sciences (ED) # 522

Title: Personnel Utilization Technology
Budget Activity: Technology Base #1

6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63202F

DDO Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Propulsion Subsystems Integration (APSI)
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	19,000	18,416	23,100	23,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the design, development, and test of new techniques aimed at successful propulsion/airframe integration and compatibility, and improved installed performance in advanced aircraft. The scope of the program includes work on: (1) advanced inlet, fan, power turbine, engine control and nozzle components; (2) integrated testing of these components with advanced gas generators (i.e., Joint Technology Demonstrator engine); (3) methods to reduce engine life cycle cost; (4) definition of engine inlet/exhaust system installation design criteria and propulsion integration technologies; and (5) engine structural design criteria through hardware fabrication and test. These efforts will ensure stall-free engine operation over a broad mission envelope. Proper attention to the efforts under this program will provide aircraft systems with the potential for longer range, higher cruise speed with lower specific fuel consumption, excess power for successful engagements, high sortie rates with reduced maintenance, and reduced life cycle cost.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Level II Joint Technology Demonstrator Engine (JTDE) efforts incorporating extended performance verification and structural/diagnostic test and evaluation will be continued. Initial altitude performance assessment will be conducted on a small engine JTDE. JTDE Accelerated Durability Assessment Configuration (ADAC) vehicles will be subjected to initial experimental accelerated mission testing (XAMT). A piggyback engine test will provide final verification of a life cycle cost model previously developed under this contract. Critical variable cycle engine technology demonstrations will focus on verification of operating characteristics through slave engine and rig tests at sea level and altitude conditions. This request will provide for: (1) initial altitude performance test assessment on a large engine JTDE; (2) small engine JTDE initial altitude test assessment and evaluation (3) Level II structural/diagnostic and extended performance characterization of a large engine JTDE; (4) life assessment testing of two large engine JTDE (5) exhaust system infrared signature reduction and control concept model testing and analysis (6) piggyback engine test of component designed for reduced life cycle cost (7) complete rig/environmental test of an advanced composite fan and (8) initiation of advanced low pressure turbine materials application and integrated control system development efforts. The cost estimates for this program are based upon contractual commitments which extend through early FY 83 plus historically backed cost estimates for a level of effort testing which is included in the APSI Five Year Plan as directed by the APSI Program Management Directive.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	19,000	13,500	21,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63202F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Propulsion Subsystems Integration (APSI)

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides for the development and functional demonstrations for those advanced technologies which are necessary to assure propulsion and airframe compatibility, and permit the attainment of advanced performance objectives in future aircraft systems. The scope of this program includes: (1) the development of advanced components related to inlets, fans, power turbine, augmentors, controls and exhaust nozzles; (2) the overall integration of these components with the basic advanced gas generators to form a demonstrator engine to define the flow path and assess the durability/life aspects of the engine concepts; (3) the development of methods to reduce engine life cycle costs by 20-25 percent; (4) the definition and verification of the methodology to structurally design, analyze, and test turbine engines to achieve increased engine durability; and (5) the definition of improved inlet/engine/exhaust system installation design criterion and propulsion integration techniques. The components being developed will provide the basis for 10-20 percent reduction in specific fuel consumption, 10-15 percent increase in stall margins, 15-20 percent reduction in engine weight, increased life/durability, 15-30 percent reduction in engine life cycle cost and greater airflow matching potential when compared to the most modern engines currently in the inventory. These benefits can be traded off against one another to meet the specific needs of systems of interest. This program provides both the critical technology baseline for future system development and a source of data for ensuring the orderly resolution of any propulsion system problems encountered with development engines.

(U) RELATED ACTIVITIES: The exploratory development base for this program is provided by Aerospace Propulsion Program Element 62203F, Materials Program Element 62120F, and Aerospace Flight Dynamics Program Element 62201F. Close technical coordination is maintained with the Air Force Flight Dynamics Laboratory, Aerospace Structural Materials Program, Program Element 63211F, and with the Air Force Materials Laboratory. This program is closely related to the Advanced Turbine Engine Gas Generator program, Program Element 63216F, which is managed from the same office and provides the core gas generator development efforts. This program is thoroughly integrated with the Navy component work under Program Element 63210N, Advanced Aircraft Propulsion Subsystem, which is developing compatible components for a cooperative Air Force/Navy demonstration of advanced engine technology. The Air Force and the Navy currently have a formal Memorandum of Understanding covering efforts under the Joint Technology Demonstrator Engine (JTDE) program. Close coordination is maintained with related efforts conducted by the Army and National Aeronautics and Space Administration.

(U) WORK PERFORMED BY: This program is managed by the Air Force Aero Propulsion Laboratory, Wright-Patterson AFB, OH. The current contractors involved in this program and their work areas are: Detroit Diesel Allison Division of General Motors, Indianapolis, IN (Advanced Fan Aerodynamics, Joint Technology Demonstrator Engine, Reduced Cost Concepts); Garrett AirResearch, Phoenix, AZ (Low Cost Component Development); General Electric, Evendale, OH (Joint Technology Demonstrator Engine, Variable Cycle Engine, Reduced Cost Components, Structural Methodology); McDonnell Douglas, St. Louis, MO (Inlet/Aircraft Drag Investigation, Propulsion Simulator); Pratt & Whitney Aircraft, West Palm Beach, FL (Variable Cycle Engine, Structural Design Criteria, Joint Technology Demonstrator Engine); Teledyne CAE, Toledo, OH (Low Cost Component Development, Joint Technology Demonstrator Engine, Structural Methodology); Rockwell International, Los Angeles, CA (Inlet/Nozzle Flight Validation).

Program Element: #63202F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Propulsion Subsystems Integration (AFSI)
Budget Activity: Advanced Technology Development, #2

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: During FY 1980 initial testing of a small engine Joint Technology Demonstrator Engine (JTDE) with adjustable turbine cooling completed initial performance test assessment. Initial performance testing of a large engine JTDE was completed and a second large engine variable cycle JTDE completed assembly/instrumentation in preparation for initial performance testing. Fundamental performance characteristics were documented to establish the baseline for future work. Design efforts on variable cycle technology system oriented concepts continued with completion of life cycle cost analysis and VCT demonstrator cycle analysis. The preliminary design effort was completed and long lead hardware procurement initiated for an advanced composite fan. Considerable effort continued on the structural design and methodology program. Rig designs and refined analyses based on previous program tasks including piggyback environmental tests were completed by three contractors. Reduced cost components fabrication continued in preparation for rig and piggyback engine tests. In the exhaust system IR signature reduction and control area concept identification and selection was completed based on integrated weapon systems assessment. Efforts for the Phase II model tests was initiated. Wind tunnel tests were completed for advanced nonaxisymmetric nozzles for air-to-ground application. Preparations were completed for initial engine testing of advanced exhaust nozzle materials. Initial cell installation checkout was completed on the propulsion simulator.

2. (U) FY 1981 Program: Seven contractual efforts previously begun will be completed during this time period. The reduced cost program will culminate with the performance verification testing of selected components. These programs will confirm that reduced cost components can be successfully fabricated and rig testing will verify that these components specifically designed to reduce life cycle cost by 10-30 percent can withstand the engine operating conditions. The structural design and development program will be completed with comprehensive environmental rig testing which will run the selected components to destruction. The test results will be used to verify that predicted failure modes and durability can be accurately predicted, verified and utilized in subsequent design practice. The initial advanced exhaust materials effort will be completed with an engine test which will provide an evaluation of the material in a realistic slave engine environment as well as evaluation of selected IR suppression devices. Advanced nonaxisymmetric nozzle assessment will be completed with evaluation of air-to-air application wind tunnel tests. This program will provide the effects of nozzle design options on base drag reductions. The propulsion simulator effort will be completed and will provide capability for more cost-effective wind tunnel testing. In the JTDE program initial performance testing will be completed on the first fully variable cycle JTDE. This test will establish the high spool/low spool interactive effects as well as the variable cycle effects. Two extended performance/structural diagnostic tests will be completed on the small engine JTDE. The Variable Cycle Technology programs will complete hardware fabrication and preparation for testing on a component rig and in a slave engine demonstrator. The design of an advanced composite fan will be completed. Four new starts will be initiated in this time period with three emphasizing the structural durability area. The new starts include: JTDE Accelerated Durability Assessment Configuration (ADAC) Experimental Accelerated Mission Testing (XAMT), Life Cycle Cost/Damage Tolerance Assessment, Propulsion Simulator Applications for Highly Integrated Aero Propulsion Configurations, and Advanced Exhaust System Materials Demonstration. Priority will

Program Element: #63202F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Propulsion Subsystems Integration (APSI)

Budget Activity: Advanced Technology Development, #2

be given to the JTDE ADAC XAMT whereby JTDE technologies will be subjected to extensive durability assessment through severe testing in a complete engine demonstrator. This program will permit earlier extensive durability assessment of selected key JTDE component technologies. The advanced exhaust system materials programs will provide evaluation of full application of advanced materials in the augmentor and nozzle culminating in a slave engine test. The Life Cycle Cost/Damage Tolerance Assessment will develop a damage tolerant design system and provide a life cycle cost evaluation of it applied to hot section components.

3. (U) FY 1982 Planned Program: Efforts during this time period will be concentrated on the Joint Technology Demonstrator Engine (JTDE) area. Extended performance/structural diagnostic testing will be conducted on two large engine JTDEs and fabrication/procurement of a third large engine JTDE will be completed. Initial altitude testing will be completed on a small engine JTDE. The initial life assessment testing of two large engine JTDE Accelerated Durability Assessment Configuration (ADAC) will also be conducted with follow-on testing in the outyears. These tests will provide extensive durability assessment of key JTDE Component technologies. Concepts in the Variable Cycle Technology program will be assessed in sea level and altitude engine testing. In the advanced composite fan program single blade foreign object damage testing and a full aerodynamic rig test will be conducted. Engine piggyback tests will be conducted on two reduced cost components previously developed. Model testing and analysis will be completed on selected exhaust systems Infrared signature reduction and control concepts. Three new efforts will be initiated: (a) Propulsion System Control Development and (b) Eutectic Low Pressure Turbine. The control system program will develop the technology for integrated control systems with expanded aircraft flight control requirements. The eutectic LPT program will supply technology to provide increased temperature capability in advanced low pressure turbine designs. (c) The Engine Durability Assessment program will establish life assessment testing philosophy for determining baseline durability and life values for advanced hot section components. The increased funding for this program in FY 1982 is the result of FY 1982 amendment addition to sustain the Congressional initiative in FY 1980 and FY 1981.

4. (U) FY 1983 Planned Program: Efforts during this time frame will continue to concentrate on the JTDE test assessment area. Initial performance testing will be conducted on one large engine JTDE. Initial cycle endurance testing will be conducted on a large engine and small engine JTDE. Two large engine JTDE Accelerated Durability Assessment Configurations (ADAC) will complete their second Experimental Accelerated Mission Tests (XAMT) using Life Assessment Testing Philosophy and a small engine JTDE ADAC will complete similar testing. Component selection, design and fabrication using damage tolerant design criteria will be completed on selected components. The propulsion simulator for highly integrated systems will be fabricated for wind tunnel model tests. Piggyback tests will be conducted for engine environmental data on selected hot section components in the Engine Durability Assessment program. Fabrication of the advanced exhaust system with advanced materials will be completed in preparation for high performance turbofan slave engine testing. Four new efforts will be initiated: (a) Advanced Fan-Single Stage (b) Advanced Augmentor Development (c) JTDE Component Integration Performance/Structural Characterization and (d) JTDE Altitude Environmental Characteristics.

5. Program to Completion: This is a continuing program.

6. Milestones: Not Applicable.

7. Resources: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63203P

DOD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT								
		7,698	13,250	17,400	23,900	Continuing		
666A	Advanced Aircraft Navigation	2,350	2,450	3,900	6,800	Continuing		Not Applicable
69CK	Advanced Devices	1,966	2,500	3,300	4,100	Continuing		Not Applicable
69DF	Advanced Weapon Delivery	3,382	8,300	6,700	6,900	Continuing		Not Applicable
2733	Advanced Reconnaissance/Strike Radar			3,500	6,100	Continuing		Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The threat posed by the Warsaw Pact is steadily increasing in both quantity and quality. To establish a capability to successfully contend with the threat postulated for the mid to late eighties, our forces require significant improvements in the performance provided by aircraft avionics. This program element is the principal Air Force source of advanced technology for avionics that accomplish the navigation, target acquisition, weapon delivery and fire control functions.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program will accomplish a carefully selected set of efforts that collectively represent a balanced approach to the satisfaction of the Air Force's requirements for affordable and reliable high performance avionic systems. The individual tasks will address specific needs such as improved aircraft survivability, improved navigation and weapon system resistance to enemy countermeasures, improved target acquisition capabilities, improved weapon control with reduction of pilot workload, and improved avionics supportability. Cost estimates are developed and provided by the concerned program offices.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	8,300	14,900	18,700		Continuing		

(U) OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #63203F

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force requires significant improvements in weapon system performance and availability if the United States and its North Atlantic Treaty Organization allies are to maintain a capability to successfully counter the threat posed by the Warsaw Pact. Key elements of this threat are a numerically superior air force and an environment characterized by intense electronic countermeasures and dense surface-to-air weaponry. The air-to-air and air-to-surface capability required by the Air Force to contend with this scenario can not be achieved effectively or economically without exploiting avionics technology currently emanating from basic research. The Advanced Avionics for Aircraft Program is the Air Force's principal vehicle for the advanced development of avionics technology needed for navigation, target acquisition, weapon delivery and fire/launch control systems. The general goals of all work in these areas are improved weapon system performance, reliability and survivability with reduced pilot workload and decreased life cycle costs. The Advanced Aircraft Navigation Project is developing sensors, antennas, subsystems and subsystem integration techniques that are required for navigation, radar and flight control reference. The Advanced Devices Project is the only Air Force project for the advanced development of system-critical components and devices that are not available commercially. The Advanced Weapon Delivery Project is developing technology for air-to-air fire control, air-to-ground fire control and multimode fire control. The Advanced Reconnaissance/Strike Radar Project is a new start in FY 1982 that will develop radar and radar related technology heretofore accomplished under the Advanced Weapon Delivery Project.

(U) RELATED ACTIVITIES: The technology base for this program's developments is established under Program Element (PE) 62204F, Aerospace Avionics. This program provides technology products which have application in PAVE MOVER (PE 63747F), Aircraft Avionics Equipment Development (PE 64201F), Tactical Identification Systems (PE 63742F), Flight Vehicle Technology (PE 63205F) and Reconnaissance Sensors/Process Technology (PE 63208F). The technical program content is coordinated with Navy PE 63202N and Army PE 63207A programs responding to similar objectives.

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright Patterson Air Force Base, OH, under the overall management of the Air Force Systems Command, manages the projects in the Advanced Avionics for Aircraft Program. Contractors include: General Dynamics, Fort Worth, TX and First Ann Arbor Corporation, Ann Arbor, MI for the Missile Launch Envelope programs; General Electric, Binghamton, NY for Firefly III; C.S. Draper Laboratories, Cambridge, MA for Advanced Global Positioning System Inertial Integration Technology development; Raytheon Company, Bedford, MA for development of the Gallium Arsenide Impact Ionization Avalanche Transit Time Combiner, Litton, Palo Alto, CA for development of the X-Band Radar Coupled Cavity Traveling Wave Tube; Hughes Aircraft Company, Culver City, CA for the infrared focal plane array effort; and Rockwell, Anaheim, CA for the development of an advanced bubble memory.

Program Element: #63203F

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1980 and Prior Accomplishments: This program accomplished the Forward Looking Advanced Multimode Radar flight test effort that successfully demonstrated the feasibility of a high resolution synthetic aperture radar. Real time digital processors, the key to autonomous airborne operations, which are used in high performance radar systems such as the F-15 AN/APG-63, were first developed within this program element. Low Light Level Television and Forward Looking Infrared sensors which are major advances in capability upgrading of the B-52 aircraft were developed within this program element. This program demonstrated the feasibility of using electrostatic gyros in a strapdown configuration for medium accuracy inertial systems. Improvements in modeling and Kalman filter techniques have led to the optimum integration of inertial systems with other navigation systems such as a Doppler, Long Range Navigation and the Global Positioning System. A solid state weapon delivery computer developed by the Advanced Devices Project was used by the Navy in the Angle Rate Bombing System validation flight tests. Algorithms for missile launch envelope determination have been provided for integration in the F-16. The Radar Director Fire Control System effort was concluded in FY 1980 with the determination that a hybrid system such as the Integrated Gunfire Control System should provide the capability for all aspect fire control.
2. (U) FY 1981 Program: 666A The Global Positioning System (GPS) null steering antenna will undergo flight evaluation. The design of the Integrated Inertial Reference Assembly will begin. This assembly will demonstrate that an integrated set of redundant sensors can provide the inertial data required for navigation, flight control and weapon delivery more reliably and economically than the array of dedicated sensors in aircraft today. The design of an adaptive multifunction L-Band antenna will begin. The Advanced GPS/Inertial Integration Technology effort will be completed. The techniques developed under this effort will provide major improvements in the capability of GPS receivers. 69CK The effort on silicone nitride radomes for missile application will near completion. An effort on two-micron bubble memories will continue with the objective of developing a high speed memory having 10,000 hours mean-time-between failure. Efforts on X-Band Radar Coupled Cavity Traveling Wave Tubes and the high-power Gallium Arsenide Impact Ionization Avalanche Transit Time Combiner will continue. These devices are critical to the acquisition of more efficient and reliable transmitters for missile and aircraft radars. The design effort on infrared focal plane arrays will be completed. 69DF An integrated fire/flight control effort (FIREFLY III) will begin flight evaluation of hardware using the F-15B aircraft. Simulation tests will be conducted on an all-aspect gun control system. Efforts on an advanced infrared sensor and track system will begin. Other efforts to improve air-to-air and air-to-ground radar capabilities will continue.
3. (U) FY 1982 Planned Program: 666A The development of the Integrated Inertial Reference Assembly will progress through completion of the preliminary design. The multifunction L-Band antenna for radio navigation and communication will be fabricated and delivered for evaluation. An effort to develop the technology for an integration of the hardware associated with the Global Positioning System, the Joint Tactical Information Distribution System and Inertial Navigation Systems will progress through the mid point of simulation evaluations. 69CK Complete the development of a silicon nitride radome capable of maintaining its structural integrity and microwave transmission properties under the stress

Program Element: #63203P

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology Development, #2

of hypersonic flight. Complete the effort on two-micron bubble memories. Initiate the development of a solid state phased array antenna required for next generation radar systems. Continue work on combiners, traveling wave tubes, analog to digital converters and the standard Carbon Dioxide Laser. 69DF Start flight test of the Integrated Gunfire Control System. Complete the development of launch envelope algorithms for the AIM-7 and AIM-9 missiles. These algorithms will provide significant improvement in missile utilization by fighter pilots. Initiate the development of launch envelope algorithms for the Advanced Medium Range Air-to-Air Missile. 2733 This project is new, but all efforts in FY 1982 are continuations of work initiated in Project 69DF. Project 2733 is being established to facilitate better management of the development of critical airborne radar technology. Tasks include continuation of simulation of the cockpit workload improvements to be derived from improved radar/pilot interfaces, simulation and assessment of slow ground moving target indication techniques, development of radar augmentation with radio frequency cueing, development of low probability of intercept terrain following radar, demonstration of real-time ultra-high resolution synthetic aperture radar and integration of a high performance processor for airborne applications. The reduction in the estimated resource requirements of this program element relative to those identified in the FY 1981 Descriptive Summary is the result of Air Force reprogramming made necessary by higher priority requirements.

4. (U) FY 1983 Planned Program: 666A Continue development of a high accuracy ring laser gyro and the integrated inertial reference assembly. These efforts will provide the technology needed for the compact reliable and high performance navigation systems in the next generation of aircraft. Continue the development and demonstration of an advanced anti-jam receiver for Global Positioning System signal reception. Continue the development of the adaptive multifunctional antenna and the associated integrated navigation system simulation. These development activities are key to plans to reduce the weight and size of aircraft avionics while simultaneously improving reliability, affordability and performance. 69CK The project will complete the development of the high power gallium arsenide combiner, the X-Band radar coupled cavity traveling wave tube and the ultra-high frequency power source. These devices will provide the capability for more reliable, higher efficiency transmitters in airborne radars and radios. Development of the solid state phased array antenna, a standard family of analog-to-digital converters and the standard carbon dioxide laser will continue. The project will initiate the development of a millimeter wave tube to satisfy the requirement for an improved electronic warfare capability in the millimeter-wave band. 69DF The project will complete the demonstration of the Integrated Gunfire Control System that will have twice the probability of kill of current gunnery systems. Missile launch envelope algorithms for the Advanced Medium Range Air-to-Air Missile will be completed. Other efforts that provide improved weapon delivery capabilities that will be accomplished are discussed in the project section. 2733 The evaluation of pilot workload improvement to be acquired through proper radar augmentation will be completed. The advanced development of a low probability of intercept terrain following radar will be completed. This system will provide the stealth required for improved low altitude penetration. The project will complete demonstration of the real-time ultra-high resolution synthetic aperture radar. The project will initiate the design of an advanced slow ground moving target indicator radar.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Not applicable.

Project: #69DF

Program Element: #63203F

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Advanced Weapon Delivery

Title: Advanced Avionics for Aircraft

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Warsaw Pact threat poses massed armor, ground mobile counter air, and a numerically superior air force that has increased the criticality of the need for more sophisticated avionics systems. To counter this threat, air-to-ground attack must be conducted beyond the strike envelopes of the ground air defenses; thus requiring avionic systems with increased target acquisition and weapon delivery range. These new avionic systems must also be able to attack multiple targets per pass to counter the adversary's numerical superiority. The air-to-air engagement is similarly characterized by the need to increase the kills per sortie to offset our numerical inferiority. This project addresses these needs by developing advanced technology for air-to-air fire control, air-to-ground fire control and multimode fire control. An effort on 2nd Generation Forward Looking Infrared (FLIR) techniques is directed toward doubling the target recognition range of current FLIR systems. Secondary objectives include reduction in pod diameter from 18" to 12" (reduced aerodynamic drag) and weight from 1200 pounds to 300 pounds. The advent of the small maneuverable fighter and the sophisticated ground defense has resulted in highly dynamic fighter engagements. The Integrated Flight and Fire Control program (Firefly III) is blending the pilot and fire control inputs to provide increased accuracy in air-to-air engagements and increased survivability through nonlinear air-to-ground weapon delivery profiles. The highly dynamic fighter engagements have also led to significant errors in the missile launch envelopes thus causing missiles to be fired when the kill probability is small while missing other high kill probability launch opportunities. The Missile Launch Envelope program will develop algorithms and displays to display the target kill probability taking into account the dynamics of the attacking and target aircraft.

(U) RELATED ACTIVITIES: The technology base for this project's tasks is established in Program Element (PE) 62204F, Aerospace Avionics. The products of this project furnish demonstrated technology necessary for the Night Attack Program (PE 63249F), Aircraft Avionics Equipment Development (PE 64201F), Reconnaissance Sensor/Processing Technology (PE 63208F) and Flight Vehicle Technology (PE 63205F).

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright Patterson AFB, OH, an organization of the Air Force Systems Command, provides the Air Force program management of this project. Contractors include Hughes Aircraft, Culver City, CA, for the Forward Looking Infrared program, General Dynamics, Ft Worth, TX and the First Ann Arbor Corp, Ann Arbor MI for the Missile Launch Envelope program; McDonnell Douglas, St Louis, MO and General Electric, Binghamton, NY for the Integrated Fire Flight Control program.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The F-111D Mark II avionics originated in this project. The initial development of many night sensors used in Southeast Asia was performed in this project. The Forward Looking Advanced Multi-mode Radar flight tests demonstrated high quality synthetic aperture radar imagery in real-time using digital processing techniques. Flight testing of advanced infrared and active television systems provided quantitative performance data necessary for further development of electro-optical systems. The feasibility of the Electronically Agile Radar was demonstrated in this project. Within recent years the program emphasis has been divided between sensor and weapon delivery tasks for tactical close air support and interdiction, and the advanced radar efforts in support of advanced and strategic aircraft weapon delivery systems. In FY 1980 laboratory tests of the basic design of the Integrated Flight and Fire Control System (Firefly III) were successfully completed.

Project #69DF

Program Element: #63203F

DOD Mission Area: Electronic and Physical Sciences, #551

Title: Advanced Weapon Delivery

Title: Advanced Avionics for Aircraft

Budget Activity: Advanced Technology Development, #2

2. (U) FY 1981 Program: Flight tests of the Firefly III System will be initiated. The Integrated Gunfire Control System design will be tested on the simulator for air-to-air combat at Luke Air Force Base, AZ. This test is expected to confirm that a major operational payoff can be derived from an all-aspect gunnery capability. A demonstration of an advanced forward looking infrared focal plane array that provides high level imagery will be completed. The design of an infrared search and track system that will provide pilots a long range passive detection and track capability will be initiated. The project will also initiate an effort to develop an advanced automatic target acquisition technique for low-level air-to-surface attack. The development of a radio frequency cueing subsystem that augments weapon system radars with a long range passive cueing ability will continue. When fielded this capability will not only provide the ability to detect threat emitters, it will also decrease the likelihood of an enemy detecting our fighter by passive means. System integration will begin on a large-scale integrated-circuit processor that provides the basis for economically satisfying the processing requirements of future tactical and strategic radars. The development of the capability for real-time ultra-high resolution synthetic aperture radar imagery will continue.
3. (U) FY 1982 Planned Program: Flight tests of the Integrated Gunfire Control System will be initiated. The AIM-7 and AIM-9 Missile Launch Envelope programs that provide the means for precise real-time correlation of target location, missile launch envelope and kill probability will be completed. In combat, this correlation capability will translate to a 25% reduction in missed missile launch opportunities and a 25% reduction in the number of wasted out-of-bounds missile launches. The Advanced Medium Range Air-Air Missile (AMRAM) Missile Launch Envelope program will be initiated. Work on the radio frequency cueing subsystem, the large scale integrated aircraft processor and other radar efforts will be transferred to Project 2733 for completion. Testing of the Firefly III System will continue.
4. (U) FY 1983 Planned Program: Flight tests of the Integrated Gunfire Control System will be completed. The results of these flight tests should support the projection that this system has twice the probability of kill associated with current gunnery systems. The AMRAM Missile Launch Envelope program will be completed. The Firefly III effort will be completed with the demonstration of a capability to strike ground targets accurately while engaged in maneuvers that provide a ten-fold increase in survivability against linear predictor anti-aircraft weaponry. The advanced automatic target acquisition system effort will be completed. A maneuvering attack concept evaluation for application to aircraft with austere avionics will be initiated. Work on the Infrared Search and Track System will progress through the mid-point of advanced development.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

Project #69DF

Program Element: #63203F

DOD Mission Area: Electronic and Physical Sciences, #551

Title: Advanced Weapon Delivery
Title: Advanced Avionics for Aircraft
Budget Activity: Advanced Technology

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDTEE	3,382	8,300	6,700	6,900	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	<u>3,700</u>	<u>8,600</u>	<u>10,800</u>	<u>Continuing</u>	<u>Not Applicable</u>
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FY 1982 funds in the amount of \$3,500,000 have been allocated to the new Advanced Reconnaissance/Strike Radar Project. The remainder of the reductions are the result of reprogramming actions initiated to provide funds for higher priority Air Force requirements.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63205F

Title: Flight Vehicle Technology

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

<u>Project Number</u>	<u>Title</u>	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	TOTAL FOR PROGRAM ELEMENT	9,400	7,900	6,800	10,000	Continuing	Not applicable
2506	Control of Flight						
2507	Vehicle Equipment	9,200	7,500	6,500	6,500		
2508	Aeromechanics	200	400	300	3,500		
					0		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop and flight test new aeronautical technologies in order to smoothly transition them to current and future Air Force weapon systems. Technologies investigated include enhanced flight control and weapons delivery systems for Air Force fighters, systems for increased aircraft and pilot survivability, and systems for increased aircraft fuel efficiency/range. Part of this program develops the aeronautical technologies to be integrated and demonstrated in PE 63245F, Advanced Fighter Technology Integration (AFTI), under project 2061, Fighter Attack Technology (AFTI/F-16).

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program develops in concert with PE 63245F, Advanced Fighter Technology Integration, selected technologies offering large improvements in capabilities and survivability over current fighter systems. The program will develop a Digital Flight Control System for the F-16 test vehicle providing task-tailored multimode control laws for each segment of a fighter mission. This development will provide for independent six degree-of-freedom control including direct lift, side force, and flat turns. These "new ways to fly" will greatly enhance fighter survivability and capability. In order to reduce pilot workload during the critical attack phase, advanced pilot/vehicle interface displays will be integrated into the design. The program will also develop and integrate into the F-15 and F-16 test vehicles the Integrated Flight/Fire Control I and III systems, respectively. The Integrated Flight/Fire Control I system will be demonstrated on the F-15 test vehicle to test the integrating concept with fighters using conventional analog control systems. The Integrated Flight/Fire Control III System will be demonstrated on the digitally controlled F-16 test vehicle to demonstrate the low altitude maneuvering attack capability against heavily defended ground targets and increased air-to-air firing opportunities realizable in the test vehicle. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk, and inflation.

(U) COMPARISONS WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980 Estimate</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
TOTAL FOR PROGRAM ELEMENT	8,900	7,900	6,000	Continuing	Not applicable

Program Element: #63205F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Flight Vehicle Technology

Budget Activity: Advanced Technology Development, #2

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63205F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Flight Vehicle Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Survivability becomes a major problem in the design of future aircraft. This program will address this problem by developing and demonstrating a flight/fire control system integrated with either a conventional flight control system or the more versatile digital flight control system. These technologies, when incorporated into existing or future aircraft, will substantially improve survivability while maintaining fire control accuracy. The Integrated Flight/Fire Control System will expand the weapons release regime and allow a fighter aircraft to strike a ground target without passing over the target--improving aircraft survivability by at least several orders of magnitude over present tactics. The Integrated Flight/Fire Control III System is being developed under this program for flight testing on the Advanced Fighter Technology Integration F-16 vehicle. Under this program, an independent six degree-of-freedom control capability is also being developed which will demonstrate up to a 200% increase in firing opportunities in an air-to-air combat scenario. A winglets demonstration project has been completed on a KC-135 test vehicle validating a 6% increase in fuel mileage. An Atmospheric Electricity Hazards Protection (AEHP) program will begin in FY 1981. The AEHP program will address the lightning and electromagnetic interference hazards to new generation aircraft caused by widespread use of sensitive microelectronic systems and advanced structural materials. The AEHP program will be conducted in two phases: phase I will establish preliminary hardening design criteria, methodology, and design of testbed aircraft; phase II will demonstrate optimized hardening measures of electrical/electronic subsystems on the testbed aircraft.

(U) RELATED ACTIVITIES: This program is developing the Digital Flight Control System and Integrated Flight/Fire Control III System for demonstration in PE 63245F, Advanced Fighter Technology Integration (AFTI). The AFTI program is, in turn, related to PE 63242F, Combat Aircraft Prototype (CAP). The AFTI program develops and validates technology items on a demonstrator aircraft. The CAP program draws on the items developed by AFTI in designing solutions to task capability improvements relevant to mission needs. The Digital Flight Control development is jointly funded by Navy while the entire PE 63245F is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. The Integrated Flight/Fire Control task is a joint development with the Air Force Avionics Laboratory. The Atmospheric Electricity Hazards Protection program is a joint development with the Army, Navy, National Aeronautics and Space Administration, and the Federal Aviation Administration. It will be carried out in consonance with an approved Interagency Management Plan.

(U) WORK PERFORMED BY: This program is managed by the Flight Dynamics Laboratory, Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. Flight testing of the F-15 and F-16 testbed vehicles will be accomplished at the Air Force Flight Test Center under an approved Statement of Capability. Contractors are McDonnell Douglas Corporation, St. Louis, MO; and General Dynamics Corporation, Ft. Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Detail design of the conventional Flight/Fire Control I system on the F-15 test vehicle was completed early in FY 1980. Fabrication and aircraft modification was complete in November 1980 for mid-FY 1981 flight testing. The flight test, originally scheduled for late FY 1980, was delayed due to an unanticipated complexity encountered in the software development. Detail design for the Digital Flight Control System and Pilot Vehicle Control and Display Interface was completed late in FY 1980. Fabrication and aircraft modification of the Advanced Fighter Technology Integration F-16 test aircraft is scheduled to be complete in mid-FY 1981 for late FY 1981 flight testing. The winglets technology program for reducing drag and increasing fuel efficiency has been completed

Program Element: #63205F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Flight Vehicle Technology

Budget Activity: Advanced Technology Development, #2

on a KC-135 test aircraft validating a 6% increase in fuel mileage. The technology from the program will be transferred to Aeronautical Systems Division of Air Force Systems Command in early FY 1981 as a potential retrofit for the KC-135 fleet under PE 11142F, KC-135 Squadrons.

2. (U) FY 1981 Program: The new start scheduled to be selected from Closed-Loop Environmental Control System, Atmospheric Electricity Hazards Protection, and Active Flutter Suppression for FY 1980 was, instead, postponed to FY 1981 because of budgeting constraints. The program selected for FY 1981 was Atmospheric Electricity Hazards Protection. This joint program with the Army, Navy, National Aeronautics and Space Administration, and the Federal Aviation Administration will develop and demonstrate optimal lightning and static electricity protection criteria for critical electrical and electronic subsystems in a variety of advanced technology aircraft structures. The conventional Integrated Flight/Fire Control I flight test program on the F-15 test vehicle, initially scheduled to begin in late FY 1980, was delayed due to unanticipated complexity in the software required. These problems have since been overcome and flight testing will begin in mid-FY 1981. The Digital Flight Control System for the F-16 test vehicle will begin flight testing in late FY 1981. The Integrated Flight/Fire Control III detail design for the F-16 test vehicle will continue through FY 1981.

3. (U) FY 1982 Planned Program: Phase I of the Atmospheric Electrical Hazards Protection program will continue through FY 1982. This phase will establish preliminary hardening design criteria and design of the testbed aircraft to be tested in Phase II of the program. Flight testing of the conventional Integrated Flight/Fire Control I on the F-15 test vehicle will be completed in late FY 1982. Flight testing of the Digital Flight Control System for the Advanced Fighter Technology Integration F-16 test vehicle will be completed in mid-FY 1982. This aircraft will then be modified with the Integrated Flight/Fire Control III system and flight testing will resume in early FY 1983. The difference between the 1981 and 1982 RDT&E Descriptive Summary resources data represents the decision to fund Atmospheric Electricity Hazards Protection as a new start in FY 1981 under the Vehicle Equipment project in lieu of Active Fighter Flutter Suppression as a new start in FY 1981 under the Aeromechanics project.

4. (U) FY 1983 Planned Program: Initiate a program for developing an Integrated Flight/Propulsion Control system to support the Advanced Survivable Fighter Technology program under PE 63245F, Advanced Fighter Technology Integration. Initiate an Integrated Flight/Weapons Control program using the F-15 test vehicle. This program will expand the Integrated Flight/Fire Control I system to manage missiles, smart weapons, and wide area munitions further enhancing fighter lethality. Other new start candidates include Active Fighter Flutter Suppression, an Alternate Takeoff System, and Crew Escape Technologies. Phase II of the Atmospheric Electricity Hazards Protection program will be initiated. Flight testing of the Integrated Flight/Fire Control III system on the Advanced Fighter Technology Integration F-16 test vehicle will be initiated in early FY 1983 under PE 63245F.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #2506

Program Element: #63205F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Control of Flight

Title: Flight Vehicle Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Exploratory development efforts performed during past years have identified a number of promising aeronautical technologies that offer large improvements in capability and survivability over current fighter systems. In order to provide systems developers the assurance needed to build tactical combat aircraft using these advanced technologies, the laboratory developments must be validated in flight. Project 2506, Control of Flight, develops several of these technologies for flight testing. An Integrated Flight/Fire Control I system is being developed for aircraft equipped with a conventional flight control system and flight tested on an F-15 test vehicle. A Digital Flight Control System, an Integrated Flight/Fire Control III system, and Pilot Vehicle Control and Display Interfaces are being developed for flight demonstration in the Advanced Fighter Technology Integration F-16 test vehicle under PE 63245F, Advanced Fighter Technology Integration (AFTI). The Digital Flight Control System, in conjunction with additional control surfaces on the AFTI/F-16, will provide independent six degree-of-freedom control and the capability to task tailor the flight control laws to the aircraft mission.

(U) RELATED ACTIVITIES: A portion of project 2506, Control of Flight, develops technologies for demonstration in PE 63245F, Advanced Fighter Technology Integration. The Digital Flight Control development is jointly funded by the U.S. Navy. Further, the entire Advanced Fighter Technology Integration program is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. Lastly, the Integrated Flight/Fire Control I task is a joint development effort with the Air Force Avionics Laboratory.

(U) WORK PERFORMED BY: This program is managed by Flight Dynamics Laboratory, Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. Contractors are McDonnell Douglas Corporation, St. Louis, MO; and General Dynamics Corporation, Ft. Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Detail design of the conventional Flight/Fire Control I system on the F-15 test vehicle was completed early in FY 1980. Fabrication and aircraft modification will be complete November 1980 for mid-FY 1981 flight testing. Detail design for the Digital Flight Control System and Pilot Vehicle Control and Display Interface on the Advanced Fighter Technology Integration (AFTI) F-16 vehicle was completed late in FY 1980. Fabrication and aircraft modification of the AFTI/F-16 test aircraft is scheduled to be complete in mid-FY 1981 for late FY 1981 flight testing. Simulator results indicate the AFTI/F-16 test vehicle will demonstrate several orders magnitude increase in survivability against ground targets and a 200% increase in firing opportunities in air-to-air combat.
2. (U) FY 1981 Program: The conventional Integrated Flight/Fire Control I flight test program on the F-15 test vehicle, initially scheduled to begin in late FY 1980, was delayed due to unanticipated complexity in the software required. These problems have since been overcome and flight testing will begin in mid-FY 1981. The Digital Flight Control System for the F-16 test vehicle will begin flight testing in late FY 1981. The Integrated Flight/Fire Control III detail design for the F-16 test vehicle will continue through FY 1981.

Project: #2506

Program Element: #63205F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Control of Flight

Title: Flight Vehicle Technology

Budget Activity: Advanced Technology Development, #2

3. (U) FY 1982 Planned Program: Flight testing of the Integrated Flight/Fire Control I system will be completed on the conventional analog flight controlled F-15 test vehicle in FY 1982. Development and flight test of the Digital Flight Control System in conjunction with the independent six degree-of-freedom control capability on the F-16 will be completed in late FY 1982 jointly with PE 63245F, Advanced Fighter Technology Integration. Development of the Integrated Flight/Fire Control III system for the Digital Flight Controlled F-16 test vehicle will be completed jointly with PE 63245F in late FY 1982 for flight testing in FY 1983. The increase in funds for this project reflects the slippage of the flight test for the conventional Integrated Flight/Fire Control I into FY 1982 due to the unanticipated complexity of the software involved.

4. (U) FY 1983 Planned Program: An Integrated Flight/Weapons Control program using the F-15 test vehicle is planned for FY 1983 start. Flight testing of the Integrated Flight/Fire Control III system will be initiated on the F-16 test vehicle in early FY 1983. The flight test report for the conventional Integrated Flight/Fire Control III system will be completed in early FY 1983. In late FY 1983 flight test of the Integrated Flight/Fire Control III system will be completed on the Advanced Fighter Technology Integration F-16 test vehicle and the entire system will be evaluated at Air Force combat maneuvering ranges.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	9,200	7,500	6,500	6,500	Continuing	Not applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E Funds	8,200	7,600	5,600	Continuing	Not applicable
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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63208F

DoD Mission Area: Electronic and Physical

Sciences (ATD), #551

Title: Reconnaissance Sensors/Processing Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
TOTAL FOR PROGRAM ELEMENT							
665A	Reconnaissance Sensors/Processing Technology	6,900	5,900	4,200	4,600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Program Element 63208F is a continuing Advanced Development Program Element that exploits new technologies to satisfy future reconnaissance requirements. Project 665A emphasizes the development of real and near-real time reconnaissance capabilities. This program is providing the technology base and validated concepts for new and improved reconnaissance sensors. The objective is to provide alternatives for the future to satisfy current and projected reconnaissance and strike requirements and to provide technology growth options for the Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN).

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program is comprised of advanced developments for real and near-real time reconnaissance sensor systems along with the inherent processing for timely data-exploitation. Activities in FY 1982 continues developments and validations for: automatic data processing and data handling to automate and expedite the exploitation of large quantities of reconnaissance data; automatic target cueing and classification sensor technology; and second generation Forward Looking Infrared technology and demonstration. Cost estimates for conduct of these development activities are based on best engineering estimates of experienced personnel within the Air Force Avionics Laboratory.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion Continuing	Total Estimated Costs Not Applicable
RDT&E Procurement	6,400	6,900	7,700			
	Not Applicable.					

OTHER APPROPRIATION FUNDS: Not applicable.

Project: #665A

Program Element: #63208F

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Reconnaissance Sensors/Processing Technology

Title: Reconnaissance Sensors/Processing Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The activities conducted within this program exploit new technologies to meet reconnaissance requirements. The objective is to advance technology and improve the time responsiveness of reconnaissance sensor systems in order to provide real and near-real time information to tactical commanders during day, night and all-weather conditions for effective strike and surveillance of enemy forces. The program includes advanced development of real and near-real time sensor systems, with both airborne and ground processing, for the detection, location and classification of targets concealed by camouflage, foliage, or adverse weather conditions. This program will provide the necessary technology base and concept validation for new and improved reconnaissance sensor systems. The requirements for these reconnaissance systems are identified in various requirements documents established by the operational commands.

(U) RELATED ACTIVITIES: Exploratory development efforts are phased into this program from Program Element (PE) 62204F, Aerospace Avionics. Equipment developments from this program are transitioned into engineering development PEs such as 64710F, Reconnaissance Equipment; 64756F, Side Looking Airborne Radar; and 63747F, PAVE MOVER. Coordination with the Army and Navy on related advanced development work is accomplished by direct liaison between corresponding levels of program management. PE 63203F, Advanced Avionics for Aircraft, is jointly funding the Second Generation Forward Looking Infrared (FLIR) Technology Demonstration. This support is planned to pursue the strike avionics aspects of FLIR technology as well as the reconnaissance applications.

(U) WORK PERFORMED BY: Program management is the responsibility of the Air Force Systems Command through the Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, with participation of the Rome Air Development Center, Griffiss AFB, NY. Major contractors are: Control Data Corp., Minneapolis, MN, for long wavelength radar (Integrated Multi-Frequency Radar); Fairchild Camera, Mountain View, CA, for long range low contrast imagery (Long-Range Electro-Optical Reconnaissance System); Perkin-Elmer Corp., Wilton, CT, for Target Cueing/Classification System (3-Dimensional target Cues); and Hughes Aircraft Co., Culver City, CA, for Second-Generation FLIR Technology Demonstration.

Project: #665A

Program Element: #63208P

DoD Mission Area: Electronic and Physical Sciences (ATD), #551

Title: Reconnaissance Sensors/Processing Technology
Title: Reconnaissance Sensors/Processing Technology
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Developed and proven technologies for new reconnaissance sensors and for improvements to existing systems that were provided under this program include: the long range Electro-Optical Reconnaissance (LOREORS) System demonstrated high resolution and increased sensitivity for image collection in heavy haze; a butted chip demonstration of the Forward Looking Infrared (FLIR) focal plane resulted in a marked improvement over the current generation common module thermal imaging system. The Image Screener effort formed the technology base for the real time automatic target detection capabilities transitioned into the Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) program to provide the F-16 and A-10 with a multiple launch per pass capability.
2. (U) FY 1981 Program: The initial automatic screening work conducted under the Automatic Image Screening and the Augmented Target Screener Subsystem investigations will be pursued in FY 1981. Other activities in FY 1981 include continuation of the Automatic Target Cueing/Classification Sensor development; the Second Generation Forward Looking Infrared (FLIR) technology Demonstration; a new effort in data handling for real/near-real time sensors; and follow-on to the FLIR Technology Demonstration, entitled Advanced Target Acquisition. A new development, Airborne Imagery Transmission (ABIT), will be initiated to provide data link capabilities for advanced reconnaissance sensors.
3. (U) FY 1982 Planned Program: Testing will continue for Auto Image Screening and Auto Target Cueing/Classification Sensor ABIT, Advanced Target Acquisition, and Data Handling. These advanced technologies support both reconnaissance and strike requirements. In addition, studies for an All Weather Identification System will be pursued to integrate various sensor and processing technologies to provide a day/night, all weather detection, location and identification capability. The funding for FY 1982 has been modified to reflect realignment of technology development. Proposed new starts were deferred.
4. (U) FY 1983 Planned Program: Advanced development will be completed for the Auto Target Cueing/Classification Sensor, Auto Image Screening and Data Handling. Development activities shall continue for Advanced Target Acquisition, ABIT, and the All Weather Identification System. New developments to be initiated in FY 1983 will be addressed following definition of outyear funding in the FY 1983 Air Force Budget planning exercise.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63211P

Title: Aerospace Structures and Materials

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Program to Completion
TOTAL FOR PROGRAM ELEMENT							
		13,313	18,600	19,900	25,100	Continuing	Not applicable
69CW	Advanced Composites	5,003	7,000	8,350	9,800		
486U	Advanced Metallic Structures	5,010	7,400	6,350	8,900		
2100	Laser Hardened Materials	3,300	4,200	5,200	6,400		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the only Air Force advanced development program established to demonstrate the feasibility of application of new materials, advanced structural design concepts, and new fabrication technology to Air Force systems, subsystems, and components. Metallic, nonmetallic, and laser hardened structures and components are designed with the advanced materials and new design/fabrication technology and are built and tested to complete the validation process. The result is a demonstrated technology for improved structural integrity; damage tolerant and durable structures; weapon system options with reduced cost, weight, and technical risk; and improved system capability.

(U) BASIS FOR 1982 RDT&E REQUEST: This program will develop advanced reinforced titanium compressor blades having improved durability and yielding about a 15% increase in allowable blade tip speed, a 15-30% weight reduction, a .2% improvement in engine specific fuel consumption and improved thrust-to-weight ratio. These will provide the increased capability, fuel efficiency, and durability required for the next generation of turbofan engines. Advanced composite MX Stage IV and deployment module applications will be demonstrated providing about a 20% weight and cost savings, reducing weapon system costs and providing increased payload/targeting options. Laser hardened tactical and strategic weapon systems test components will be fabricated to evaluate survivability against projected space and ground based continuous wave and pulsed laser threats. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk, and inflation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	Additional to Completion	Program to Completion
RDT&E	13,800	18,600	21,800	Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: These projects validate new materials and structural concepts to meet Air Force requirements for greater systems range, greater payload capability, runway independence, increased system/component reliability, durability, and maintainability; new and more ambitious missions; and survivability against directed energy beam threats. Advanced composites that are lighter, stronger, stiffer, and have highly directional properties are being developed for both primary and secondary major systems structure. Advanced metallic structures improving engine durability, reliability, efficiency, and performance as well as advanced metallic applications to reduce the maintenance costs of operational aircraft and new major structural concepts with greater strengths, stiffnesses, and temperature capabilities are underway. Laser hardened materials and design concept applications to aircraft, ballistic missile, cruise missile, and space systems applications are being developed and demonstrated.

(U) RELATED ACTIVITIES: Coordination with other service related activities are maintained through the tri-service Metal Matrix Composite Steering Group which met most recently on 9-11 Dec 80, the tri-service Laser Hardening Materials and Structures Working Group which met on 7 Nov 80, the biannual DOD Materials and Structures Conference, and other planning and working level committees. Close relationships are also maintained with appropriate National Aeronautics and Space Administration agencies working on related technology. This program element is meshed with portions of the Air Force Manufacturing Technology Program (Program Element 78011F), with results of each program element feeding the other; with Aerospace Flight Dynamics (Program Element 62201F), Materials (Program Element 62102F), and Aerospace Propulsion (Program Element 62203F) all of which provide the basic technology developed within the program element; and with Advanced Radiation Technology (Program Element 63605F) and Satellite Systems Survivability (Program Element 63438F) which support and benefit from the laser hardened materials effort. Due to the universal nature of materials and structures and their application, this program element has potential application for essentially every major Air Force acquisition program.

(U) WORK PERFORMED BY: This program is managed by the Air Force Wright Aeronautical Laboratories' Materials Laboratory and Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The major contractors for the program include: Northrop Corporation, Hawthorne, CA; The Boeing Company, Seattle, WA; General Electric, Evendale, OH; Grumman Aerospace, Bethpage, Long Island, NY; McDonnell Douglas, St. Louis, MO and Long Beach, CA; AVCO Corporation, Lowell, MA; General Electric Company, Philadelphia, PA; Honeywell, Inc., Minneapolis, MN; Goodyear Aerospace Corporation, Litchfield Park, AZ; Raytheon Corporation, Waltham, MA; Hughes Space Systems, El Segundo, CA; TRW, Inc., Redondo Beach, CA; Vought Corporation, Dallas, TX; Rockwell International, Los Angeles, CA; General Dynamics Corporation, San Diego, CA; and McDonnell Douglas, Huntington Beach, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: New, high precision and reliable bulk aluminum casting technology was demonstrated and transitioned to the air launched cruise missile. Adhesive bonding of primary fuselage structures has been demonstrated as structurally sound and a source of at least 30% cost savings compared to existing fabrication techniques. Design of the Built-up Low Cost Advanced Titanium Structure wing carry through structure section was completed and fabrication begun. Advanced Ballistic Reentry Vehicle advanced composite substructure detailed design, fabrication and both standard and underground testing have been successfully completed. Designs for advanced composite application to both MX structures and satellite main body structures have been completed.

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

Design guidelines have been developed for the Global Positioning System and Defense Meteorological Satellite Program satellite systems to provide future design criteria and to guide the hardening programs. Testing has been completed on a subscale aircraft canopy that was laminated to achieve environmental durability, laser hardness, and bird impact resistance. An effort to develop concepts and hardened material to meet far term ground based and space based threats was completed and demonstrated on subscale components under the Satellite Materials Hardening series of programs. New efforts were initiated to extend hardening concepts to pulsed threats.

2. FY 1981 Program: MX full scale advanced composite stage IV and deployment module structure articles will be fabricated. Testing of the composite satellite equipment support module will continue. Fabrication will begin of the composite wing/fuselage critical component, and development of qualification testing methods will also begin. Several advanced fiber reinforced metal matrix composite efforts including design data generation, design development, and payoff assessments will start. An effort to apply advanced materials and structures to operational aircraft secondary structures will be initiated to significantly lower maintenance costs. A payoff assessment effort for the application of radar absorbing structures to Air Force systems will begin. The validation of

3. FY 1982 Planned Program: Advanced titanium compressor blades requiring no mid-span damping will be fabricated with a 15-30% weight reduction relative to state-of-the-art blades and with a higher operating temperature. New material turbine blades with a 250 degree improvement in temperature capability relative to the state-of-the-art will be demonstrated. Metal matrix composite material and advanced powder metallurgy aluminum evaluations will be performed. Testing of subscale and full scale composite MX missile structures will be completed yielding an expected 20% decrease in both component cost and weight. This will result in improved payload/range capability or the ability to absorb weight increases elsewhere in the system. Systems verification of an advanced composite satellite equipment support module will also be completed. Subscale and full scale satellite and electro-optical components will be fabricated for

4. (U) FY 1983 Planned Program: The composite aircraft wing/fuselage and inertial upper stage programs will be completed. Work will begin in a comprehensive integrated computer aided design (ICAD) development and application project. An advanced composite effort will begin for large aircraft primary structure. Advanced reinforced titanium fan and eutectic high pressure turbine blade efforts will be completed. A new vibration damping program will be initiated for advanced metallic structure satellite applications. Full scale development of satellite level I laser hardened components will be completed, and evaluation and implementation will begin. Level II hardened components will be developed and fabricated, and testing will begin.

5. (U) Program to completion: This is a continuing program.

6. (U) Milestones: Not applicable.

Project: #69CW

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Composites

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops, demonstrates, and evaluates advanced composite materials for Air Force weapon systems and aerospace applications. The lightweight, high stiffness and strength, and tailorability of the properties of advanced composites provide unique capabilities and high likelihood of being a key technology necessary for many Air Force requirements including runway independence, greater range and payload capability, unique mission performance abilities, lower fuel usage, and reduced cost of operation and maintenance. The project has two major thrusts: materials and engineering design development and hardware demonstrations. The materials and engineering design development area results in new material systems of lower cost and develops the substantiating and supporting technology required to assure the suitability of these materials in systems applications. Hardware demonstrations are conducted to demonstrate the feasibility of a fully integrated concept of materials design and manufacturing, and to achieve the anticipated weight savings, flight worthiness and other potential advantages. Over the next ten years, the output of this project is expected to make composite structures less costly than metal items, while providing significant increased performance options to the aircraft, missile, satellite, and engine designer.

(U) RELATED ACTIVITIES: This program is related to Materials (Program Element 62102F) and Aerospace Flight Dynamics (Program Element 62201F). Coordination is accomplished with the Army, Navy, National Aeronautics and Space Administration, and industry through joint planning, technical symposia, professional societies, reviews of contractors' Independent Research and Development Programs, and technical reports.

(U) WORK PERFORMED BY: Work is performed by the Air Force Wright Aeronautical Laboratories' Materials Laboratory and Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The major contractors for the program include: Northrop Corporation, Hawthorne, CA; Grumman Aerospace, Bethpage, Long Island, NY; McDonnell Douglas, St. Louis, MO; The Boeing Company, Seattle, WA; Rockwell International, Los Angeles, CA; and AVCO Corporation, Lowell, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Advanced composite ballistic missile reentry vehicle deployment module has been fabricated yielding a 21% weight savings. Detailed design of advanced composite MX Stage IV primary structure components and system configuration also has been completed. Likewise, detailed design has been completed for an advanced composite satellite equipment support module. An advanced composite detailed design trade-off evaluation has been conducted for the inertial upper stage. Shielding of composites from electro-magnetic pulses has been demonstrated.
2. (U) FY 1981 Program: Full-scale MX reentry vehicle deployment module and Stage IV test components will be fabricated for static and dynamic testing. Development of qualification testing methods and fabrication of composite wing/fuselage component material will be initiated. Structural verification testing of the satellite equipment support module will be completed and systems verification testing will be initiated. Detailed design and fabrication of an advanced composite structure for the inertial upper stage will continue. A new effort for space based surveillance hardware and one for radar absorption structure assessment will start.

Project: #69CW

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Composites

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

3. (U) FY 1982 Planned Program: A wing/fuselage advanced composite structure damage tolerance effort will begin and full scale testing of wing/fuselage advanced composite structure durability will progress toward completion. A radar absorbing structure hardware development effort, for application to aircraft or cruise missile systems, will follow the FY 1981 assessment effort. The MX composite Stage IV design and deployment module demonstration will be completed. This effort which is fully coordinated among the Ballistic Missile Office, its contractors, and the laboratory and its contractors, will provide about a 20% weight savings and a 20% cost savings relative to state-of-the-art materials and structures. The reduction from \$10,500K (from FY 1981 budget data) to \$8,350K was due to a shift of propulsion work from project 69CW to project 486U and to an overall Air Force Advanced Technology funding prioritization within the funds available. The former aspect had no impact; the latter caused a reduction in the scope of the inertial upper stage advanced composite effort.

4. (U) FY 1983 Planned Program: A comprehensive program to engineer and demonstrate application of advanced composite materials for nearly all primary and secondary large aircraft structure will be initiated. A program applying advanced composites to spaced based surveillance hardware will begin. All structural testing of advanced composite wing/fuselage structure will be completed, as will composite inertial upper stage testing.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Program to</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Completion</u>
RDT&E	5,003	7,000	8,350	9,800	Continuing	Not applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>						
RDT&E	5,700	7,200	10,500		Continuing	Not applicable

Project: #486U

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Metallic Structures

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the design, fabrication, test, and evaluation of aircraft primary and selected secondary structures using new metallic concepts such as metal matrix composites, advanced powder metallurgy, and the latest metal alloys; all combined with advanced structures technology. Reduced acquisition and maintenance costs, increased structural integrity, new mission capabilities, and more efficiently performing systems are the objectives. Major assemblies such as wing carry-through structures, fuselage sections, wing structures, and others are built and tested to demonstrate that advanced technology can satisfy these objectives. The project was initiated in 1971 to address structural problems existing with operational inventory aircraft and has been continued to provide demonstration that new technology can significantly improve the structural integrity, performance capability, and overall costs for future and current Air Force systems.

(U) RELATED ACTIVITIES: This program is related to Aerospace Flight Dynamics (Program Element 62201F), Materials (Program Element 62102F), Aerospace Propulsion (Program Element 62203F), and the Mechanics Subelement of Defense Research Sciences Program (Program Element 61102F). Coordination with Army, Navy, National Aeronautics and Space Administration, and industry is accomplished through such methods as: membership on National Aeronautics and Space Administration Advisory Committees; participation in the Tri-Service Metal Matrix Composite Steering Group which most recently met in December 1980; various professional societies; and reviews of contractors' Independent Research and Development Programs. Tri-service coordination is also accomplished during preparation of both the Materials and Structures Technology Coordinating Papers.

(U) WORK PERFORMED BY: Work is performed by the Air Force Wright Aeronautical Laboratories' Flight Dynamics Laboratory and Materials Laboratory, Wright-Patterson Air Force Base, OH. Management of the program is accomplished by the Flight Dynamics Laboratory. Contractors are: McDonnell Douglas, Long Beach, CA and St. Louis, MO; Rockwell International, Thousand Oaks, CA; The Boeing Company, Seattle, WA; General Electric, Evendale, OH; and Pratt and Whitney, West Palm Beach, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Cast Aluminum Structures Technology effort was successfully completed. The technology was transitioned to the air launched cruise missile structural bulkheads with a reduction in required parts from 28 to 4 and a savings in cost of these parts of about 35%. Primary Adhesive Bonded Structures Technology full scale fabrication of a transport aircraft wing carry-through structure and testing has been successful, demonstrating a potential cost savings of 20% and a 400% life improvement or a 15% weight savings. Six directionally solidified eutectic low pressure turbine blades were fabricated and successfully run in a J101 engine test for 16 hours. Early aluminum metal matrix structures evaluations indicated weight savings of 20-50% possible.
2. (U) FY 1981 Program: The built-up, low cost advanced titanium structure program will complete fabrication of the center fuselage test components and fatigue testing will be initiated with a payoff potential of 15% weight, 25% cost, and improved damage tolerance. Efforts will be started on the demonstration of advances in materials and structures technology for improved airframe secondary structures of operational aircraft with demonstration component selection and design. Metal matrix composite programs for titanium engine fan blades and selectively reinforced airframe structure will be continued. A full scale airframe/missile metal matrix structural component demonstration effort will be initiated with component selection. Eutectic high pressure turbine blade fabrication will begin, and metal matrix composite space and missile payoff assessments and design data generation efforts will start.

Project: #486U

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Metallic Structures

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

3. (U) FY 1982 Planned Program: Advanced, reinforced titanium fan blades will be fabricated for evaluation. These are projected to have lower weight and higher tip speeds than state-of-the-art blades and will have no mid-span damping shroud. Results in engine evaluation are expected to include both higher thrust to weight performance and a concurrent improvement in specific fuel consumption. Evaluation and engine testing will be performed for eutectic high pressure turbine blades that will have a higher operating temperature of about 250°F. These blades will also have an 8% reduction in required cooling air and an improved rupture life of about three times that of current blades, resulting in improved engine operation (thrust and efficiency) and lower operation and maintenance costs. Structural verification of advanced powder metallurgy aluminum alloys will begin with aircraft wing design, offering the potential of improved strength and stiffness to weight ratios on the order of 20-30%. Fatigue testing of built-up low cost titanium center fuselage structure will be performed.

4. (U) FY 1983 Planned Program: An effort to provide integral visco-elastic damping of space system structures will be initiated. This requirement results from the lack of atmosphere to damp vibrations generated by satellite activity such as maneuvering. Such vibration, if not damped, could compromise system performance and mission. An effort to develop and evaluate metal matrix composite turbine shafts will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Program to Completion</u>
RDT&E	5,010	7,400	6,350	8,900	Continuing	Not applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	4,610	7,300	6,600
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Project: #2100

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Laser Hardened Materials

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

DETAILED BACKGROUND AND DESCRIPTION: This project develops materials and concepts that measurably reduce the vulnerability of Air Force systems to high energy laser weapons. The project addresses hardening of critical components and subsystems of satellite systems, aircraft, and missile/sensor systems. The program is responsive to

It includes development of materials and concepts for laser hardening by retrofitting existing and near term systems as well as concepts for inherently hardening systems components for the future.

(U) RELATED ACTIVITIES: This program is related to Materials (Program Element 62102F), Aerospace Flight Dynamics (Program Element 62201F), Aerospace Propulsion (Program Element 62203F), Advanced Radiation Technology (Program Element 63605F), and Satellite Systems Survivability (Program Element 63438F). Coordination is accomplished with the Navy, Army, and Defense Advanced Research Project Agency, The High Energy Laser Review Group, through the Laser Hardened Materials and Structures group established by the Office of the Under Secretary of Defense for Research and Engineering; and industry, through joint planning, technical symposia, professional societies, reviews of contractors' Independent Research and Development Programs, and technical reports.

(U) WORK PERFORMED BY: The Air Force Wright Aeronautical Laboratories' Materials Laboratory, Wright-Patterson Air Force Base, OH, is the organization responsible for management of this program. Contractors include General Electric, Philadelphia, PA; Honeywell, Inc., Minneapolis, MN; McDonnell Douglas, St. Louis, MO; AVCO, Wilmington, MA; Goodyear Aerospace Corporation, Litchfield Park, AZ; Acurex Corporation, Mountain View, CA; Raytheon Corporation, Waltham, MA; Martin, Orlando, FL; and Hughes Aircraft, Culver City, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Subscale evaluations of concepts to protect satellite systems to the near-term threat (level 1) have been completed. Level 1 hardening fabrication of a 16-foot deployable antenna was demonstrated. Materials, fabrication, and installation techniques for protection of internal aircraft components such as avionics systems, wiring systems, and flight control systems and materials for hardening of fuel systems have been developed. Efforts have been completed for laser hardening of the AIM-9L optical system (including the IR dome) and the PAVE TACK forward looking infrared optical system.

Techniques have been developed for producing reflective surfaces on aluminum and titanium skin materials.

have been developed and evaluated for use as canopy materials which meet laser hardness goals. A full scale F-4 aircraft canopy has been fabricated and is undergoing structural and environmental evaluation.

2. FY 1981 Program: Efforts will begin for 16 full scale satellite component hardening development for electrical power, environmental control, attitude control, optical payload, and radio frequency payload subsystems. Sensor hardening technology demonstration efforts will begin. Also included is level II and level III component hardening demonstration initiation, against both continuous and pulsed laser threats.

Project: #2100

Program Element: #63211F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Laser Hardened Materials

Title: Aerospace Structures and Materials

Budget Activity: Advanced Technology Development, #2

3. (U) FY 1982 Planned Program: Fabrication will continue and evaluation/demonstration will begin for both subscale and full scale satellite and electro-optical components hardened against continuous wave and pulsed lasers, both ground and space based. Both strategic and tactical systems will be supported. Sensor hardening technology demonstration efforts will continue fabrication of hardened components.

4. (U) FY 1983 Planned Program: Advanced development scale-up of aircraft pulsed radiation hardening will begin. A hardened forward looking infrared sensor component demonstration will be initiated, as will flight test evaluation of AIM-9L hardened sensor optics. Full scale evaluation of satellite components will be performed.

5. (U) Program to Completion: This is a continuing effort.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Program to Completion</u>
RDT&E	3,300	4,200	5,200	6,400	Continuing	Not applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	3,490	4,100	4,700
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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63215F

DOD Mission Area: Engineering Technology (ATD), #553 Title: Aviation Turbine Fuel Technology
 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		3,321	4,350	6,900	8,900	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This PE's hardware testing will validate aviation turbine fuel specifications for fuels derived from low quality petroleum cruises and non-petroleum sources such as shale oil and coal. The program will concentrate on the hardware (aircraft) implications of the transition to non-petroleum fuels. The program provides the RDT&E basis for first operational use of shale fuel in the Air Force Operational Validation Program and is a part of the DOD program to utilize products incentivized by the Energy Security Act of 1980.

(U) BASIS FOR FY 1982 REQUEST: This program has been accelerated in FY 1982 to meet the anticipated schedule of first commercial synthetic fuel productions due to the Defense Production Act portion of the Energy Security Act of 1980 (Title I, Part A). The RDT&E hardware evaluations of turbine engines, auxiliary power units and fuel systems would now be completed in FY 1983 so the Operational Validation Program can be initiated in FY 1984 coinciding with those first commercial synthetic fuel deliveries. The cost estimates were derived using analogous contract manhours, material, and overhead charges adjusted for program complexity, risk and inflation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,800	4,400	2,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63215F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aviation Turbine Fuel Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Numerous studies have predicted large shortfalls in petroleum production in relation to consumption patterns. Aviation fuel costs have already risen drastically since 1973, and the Air Force FY 80 aviation fuel bill is about \$3.8 Billion even though aviation fuel consumption has been reduced by one third since 1973. Also, poorer quality petroleum crudes (Alaskan crudes as an example) make poor stock for our current specification fuels. Much of the petroleum now converted to aviation fuel is imported crude. By utilizing our domestic source of oil shale we can improve our defense posture through increased availability and security of our sources while improving our balance of payments problem. Shale derived fuel will be tested in current Air Force hardware to determine what fuel property changes can be made without incurring unreasonable system support costs. At our current consumption rates, a savings of one cent per gallon in fuel cost equates to a cost avoidance of \$36 Million annually.

(U) RELATED ACTIVITIES: This program extends the work of Program Element 62203F, Aerospace Propulsion. This program and the companion exploratory development programs in PE 62203F are coordinated with National Aeronautics and Space Administration and Department of Energy. NASA is conducting cooperative planning with the Air Force Aero Propulsion Laboratory to assure the military and civilian synthetic fuels efforts are complementary. The Army, Navy, and Air Force synthetic fuels programs are coordinated through the Under Secretary of Defense for Research and Engineering and test fuel planning in cooperation with the DOE is being coordinated through the Office of the Secretary of Defense. Test fuels acquisition, transportation and storage is being handled by the Defense Fuels Supply Center of the Defense Logistics Agency.

(U) WORK PERFORMED BY: Work is managed and performed by the Air Force Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Another Air Force organization involved in the engine testing portion is the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The majority of the work will be conducted under contracts to qualified bidders. Current contractors are: Ashland Petroleum Company, Ashland, KY; General Electric Aircraft Engine Group, Evendale, OH; Pratt and Whitney Aircraft Group, Government Products Division, West Palm Beach, FL; Sun Oil (SunTech Group), Marcus Hook, PA; UOP Process Division, Des Plaines, IL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The initial effort in this program is to identify performance degradation and durability of contemporary turbine engines such as the F100, TF39, J79, and J85, caused by steady state, transient and cyclic operations with shale derived fuels and variable quality petroleum fuels. The mainburner and turbine component work started in FY 1979. Sector burner and full size component rig testing and analysis was initiated to test a range of fuel qualities and to provide durability data. Testing is being done under contract to major turbine engine manufacturers. Combustor testing began to determine characteristics of ignition, fuel injector location, heat release rates, pattern factor, temperature distribution, radiant heat transfer, carbon formation and cooling requirements. Turbine component testing also began to determine characteristics of metal temperatures, thermal gradients, cooling requirements, and erosion of coatings. These component level evaluations resulted in a low assessment for risk. The shale processing trade-off studies were initiated in FY 1979 to determine how shale processing would affect availability and cost of aviation fuels.

Program Element: #63215F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aviation Turbine Fuel Technology
Budget Activity: Advanced Technology Development, #2

2. (U) FY 1981 Program: The mainburner and turbine component efforts will be completed. Component evaluations of turbine engine augmentors (afterburners) and auxiliary power units will be initiated. The augmentor tests will be done at both sea level and simulated altitude conditions. The shale processing trade-off studies will be completed.
3. (U) FY 1982 Planned Program: Augmentor component and auxiliary power unit evaluations will be completed in FY 1982. Full-scale engine testing will be initiated with the J79 engine completing in FY 1982. The shale processing trade-off study results/data will be used to finalize shale fuel specifications prior to Air Force acceptance of first commercial deliveries of synthetic fuels. The hardware testing/evaluation program has been accelerated so that first operational use of these commercial fuels can be made in FY 1984. The increased funding is required because the program is progressing from component level to full-scale engine testing much sooner due to the program acceleration to match first commercial synthetic fuel deliveries incentivized by the Energy Security Act of 1980.
4. (U) FY 1983 Planned Program: The F100 full-scale engine test on shale fuel will be completed. Limited flight testing on shale full will begin. All final assessments prior to beginning Operational Validation at active Air Force bases will be completed. Work on coal liquids and major fuel specification changes will start receiving major emphasis in late FY 1983 and FY 1984.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63216F

DOD Mission Area: Engineering Technology (ATD), 553

Title: Advanced Turbine Engine Gas Generator (ATEGG)
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total	
							Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT		30,000	30,940	33,400	32,300			

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program ensures that there is a continuous development and demonstration of the most advanced turbine engine high pressure core components. Advanced compressors, combustors and high pressure turbines are integrated into gas generators in which the durability, cost and performance aspects of these core engine technologies can be assessed. A building block approach is utilized to systematically assess both the independent component characteristics and the interactive, interdependent component characteristics under the most realistic operating environment. This critical integrated hardware demonstration enhances the early low risk transition of these technologies to engineering development. Advanced aircraft and/or growth aircraft systems are dramatically affected by propulsion related capability such as durability, reliability, life cycle cost and performance. These features are directly translated to thrust/weight; specific fuel consumption at cruise and in afterburner; stall-free operation; matched cycle performance within a mission envelope; ease of maintenance; lower acquisition cost; and increased reliability/durability. Proper attention to these propulsion features will ensure that advanced aircraft systems can achieve longer range, higher payload, increased maneuverability, and increased sortie rate, or trade-off any of these characteristics depending on their relative importance.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Competitive gas generator options will continue to be pursued to maintain a minimum four contractor competitive technology baseline. Emphasis will be placed on continued enhancement of durability oriented testing of hardware designs with special attention to accelerated life testing. Gas generator component designs/redesigns and testing will focus on those efforts prerequisite to the definition and full scale development of the next generation fighter engine in the mid to late 1980s time period. The focus will be on conducting those environmental characterization tests and accelerated life tests required to verify the structural design system of the advanced components. For the first time, this testing will make possible an accurate correlation between the predicted and actual design life of engine hardware. During this period, six builds/tests will be conducted on large engine gas generators and two builds/tests will be conducted on a small engine gas generator. The cost estimates for this program are based upon contractual commitments which extend through FY 1982 plus historically backed cost estimates for a level of effort test program in accordance with the ATEGG Five Year Plan and the ATEGG Program Management Directive.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Complete Continuing	Total	
						Estimated Costs	Not Applicable
	30,000	25,700	28,800				

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63216F

DDO Mission Area: Engineering Technology (ATD), #553

Title: Advanced Turbine Engine Gas Generator (ATEGG)

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This Advanced Development Program will ensure that turbine gas generator technology is available to meet the requirements of future aircraft propulsion systems. To ensure that these needs can be met requires a better definition of the engine's operating environment; advanced designs that maximize the tradeoffs between performance and life characteristics within this environment; and effective test and measurement techniques to verify this capability. The gas generator is the basic building block of the engine and it consists of a compressor, a combustor, and a turbine to power the compressor. The objective of this program is to provide the continued evolution of the most advanced core engine technologies (compressors, combustors, and high pressure turbines) into an advanced gas generator in which the performance, cost and durability aspects can be assessed in a real engine environment. This critical hardware demonstration will enhance the early low risk transition of these technologies to engineering development where they can be applied to growth systems and/or new systems. The technologies are scalable, flexible, and applicable to a wide variety of potential systems applications. Flight size, flight weight gas generators are initially tested to define flow path characteristics. Once the flow path has been characterized and mechanical integrity verified, the gas generators are subjected to accelerated life testing to characterize the structural aspects of the advanced component designs. New component technologies are introduced on a step-by-step basis so that their individual performance/structural characteristics can be assessed and so that the relationship (effect) of the new component on other components and the integrated gas generator can be accurately assessed.

(U) RELATED ACTIVITIES: Gas generator and other engine component feasibility and practicality is demonstrated initially in Exploratory Development under Program Element 62203F, Aerospace Propulsion. The other engine subsystems such as fans, controls and afterburners which, when added to the basic gas generator complete the engine, are demonstrated in advanced development under Program Element 63202F, Aircraft Propulsion Subsystems Integration (APSI). Close coordination will be continued with the Navy, Army and NASA to ensure that resources are effectively utilized for common needs. Current and planned development efforts by the Navy Advanced Propulsion Program (63210N), the APSI Program (63202F), Turbine Fuel Technology Program (63215F), Materials Laboratory (62102F, 78011F) and Flight Dynamics Laboratory (63211F) directly complement ATEGG effort.

(U) WORK PERFORMED BY: The program is managed by the Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Four turbine engine contractors are currently involved in this effort: The Detroit Diesel Allison Division of General Motors, Indianapolis, IN; Teledyne CAE, Toledo, OH; General Electric, Evendale, OH; and Pratt and Whitney, West Palm Beach, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Every commercial and military engine which has been developed since about 1967 has contained technology which was initially assessed in the Advanced Turbine Engine Gas Generator (ATEGG) program. This program is the only Department of Defense program for the integrated gas generator testing of advanced turbine engine technologies. The unique four contractor demonstration concept has proven itself through aggressive pursuit of performance goals which, when compared to operational engines, have demonstrated dramatic improvements in pressure ratio (higher pressure ratio in 50 percent fewer stages than current designs); combustor heat rise (1000°F increase in a combustor

that is 20 percent shorter than current configurations); turbine rotor inlet temperature (500-1000°F increase over current engines); and gas generator size and weight (20-30 percent decrease over current configurations). Since FY 1977, increasing emphasis has been placed upon demonstrating enhanced durability/life characteristics in advanced component designs, especially in combustor and turbine hardware. Comprehensive accelerated life testing to assess the time-dependent durability aspects of designs has become an integral part of the test program for each gas generator design. During this time period, increased structural diagnostic testing was conducted at all contractors. This testing focuses on isolation/identification of life limited components. Gas generators are heavily instrumented in order to adequately assess components. This structural diagnostic testing is prerequisite to future more complex structural tests. Specific large engine gas generator accomplishments include: (a) continued the design/fabrication on three high through flow gas generator designs; (b) initiation of the first ATEGG accelerated life test, including over 350 hours of testing and over 2000 test cycles. In this testing, the gas generator hardware was cycled to visible distress. Results of this testing have made possible for the first time an accurate correlation between the predicted and actual life of a component. This testing is considered absolutely essential to the low risk transition of advanced gas generator technology/hardware to growth and/or new development systems. Testing conditions were designed to assess the effects of time-dependent life-limiting factors (i.e., low cycle fatigue, creep, stress rupture, etc.); (c) completed the first demonstration and evaluation of the new class of high-thru-flow compressors. Excellent compatibility between the high flow combustor and compressor was demonstrated including forty-four stall recoveries; (d) demonstrated advanced instrumentation techniques which more than doubled the number of rotating channels of data acquisition for structural measurements. This is the key for structural tests and assessment efforts. Small engine gas generator efforts included initial environmental characterization. Two hundred thermal cycles and over 59 hours of testing were accomplished to ensure that the gas generator was ready for the rigors of accelerated life testing.

2. (U) FY 1981 Planned Program: During this time period, three new gas generator designs will undergo initial flowpath definition testing. A total of seven major gas generator builds/tests will be accomplished. Large engine gas generator efforts will focus on the assessment of HTF gas generators. Two large engine gas generator designs will complete a maturation process which includes comprehensive flowpath documentation and durability/life testing. This will signal a major milestone for advanced gas generator technology assessment. Specific efforts will include: (a) turbine vane environmental characterization testing and design and fabrication of a HTF gas generator at one contractor; (b) turbine environmental characterization testing including up to 800 durability cyclic, and HTF compressor fabrication at a second contractor; and (c) design and initial fabrication of a new HTF compressor and accelerated life test on a new combustor (four lifetimes when compared to current operational combustor) at a third contractor. All large engine contractors will be fabricating additional hardware needed for extended structural tests of gas generators and will initiate installation of additional structural instrumentation. Small engine gas generator efforts will be aimed at the initial flowpath testing on a new gas generator with a three-stage compressor, vaporizer plate combustor, and high rim speed turbine. This new gas generator will represent a 20 percent reduction in size compared to current small engine gas generators. An environmental characterization test/structural assurance cyclic test will be conducted on a small gas generator to determine the effects of variable cooling on the high pressure turbine. During this time period, additional hardware fabrication will be completed to support high risk structural/ durability testing.

Program Element: #63216F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Turbine Engine Gas Generator (ATEGG)
Budget Activity: Advanced Technology Development, #2

3. (U) FY 1982 Planned Program: One large engine gas generator and a small engine gas generator will complete the maturation process which includes comprehensive flowpath documentation followed by extensive durability/life testing. During this period, a testing milestone will be achieved: each contractor will conduct at least two major builds/tests and up to 5000 durability cycles for the first time in the history of the program. All contractors will be conducting accelerated life testing on gas generators. Specific large engine efforts will include: (a) turbine vane/compressor accelerated life testing (including 2000 thermal cycles), extended life assessment tests using composite test cycles and additional HTF gas generator component assessment at one contractor; (b) accelerated life testing of a new rapid solidification rate/radial wafer turbine blade and initial flowpath testing of a five-stage compressor HTF gas generator at a second contractor; and (c) turbine and combustor accelerated life testing at a third contractor. Small engine gas generator efforts include turbine blade/combustor accelerated life testing and additional flowpath performance test and new component design/integration on a three-stage gas generator. The increase level of funding between the FY 1981 and FY 1982 Descriptive Summaries is the result of FY 1982 Amendment addition to sustain the Congressional Initiatives of FY 1980 and FY 1981.
4. (U) FY 1983 Planned Program: All ATEGG contractors will be conducting extensive accelerated life tests and will have completed the initial testing of advanced HTF gas generators. This substantial increase in structurally oriented testing will provide increased confidence and reduce the risks in transitioning advanced technology options which offer a 2-4X improvement in life, 6-10% reduced fuel consumption and 20-30% lower life cycle cost. Specific large engine efforts include: (a) up to 4000 cycles of experimental accelerated mission-type durability testing over various potential system usage conditions and on initial full temperature durability assessment of a HTF gas generator at one contractor; (b) rammed-cyclic accelerated life testing of a new combustor and rapid-solidification rate/radial wafer turbine, at a second contractor; and (c) extensive accelerate life testing of hot section components and comprehensive flowpath testing of an HTF gas generator with cooling flow modulation at a third contractor. Small engine gas generator efforts include extensive life testing of all hot section components and structural diagnostic testing of the new three stage gas generator.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.
7. (U) Resources: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63227F

Title: Advanced Simulator Technology

DOD Mission Area: Environmental and Life Sciences (ATD), #552

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2363*	Advanced Visual Technology System	2,000	3,170	2,200	4,500	Continuing	Not Applicable
		2,000	3,170	2,200	4,500	3,773	19,443

* Previously titled "Advanced Tactical Air Combat Simulation."

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force must maintain a skilled force of combat-ready pilots. Improved simulator training technology can help to meet this requirement. Currently, air-to-air, air-to-ground, and terrain-following simulator training is limited by lack of visual display brightness, resolution, and image fidelity. This program element supports work in the training and personnel category of TRAINING DEVICES AND SIMULATION. It develops subsystems to improve the performance capabilities of flight simulators, with special emphasis on developing and demonstrating improved visual image generation and projection techniques to provide more realistic visual displays. In the visual display area, significant improvements in display resolution brightness and number of responsive moving targets will be possible with the development of light-valve projector technology. Advanced image generation techniques will be developed and tested for feasibility. The simulation technology developments funded and managed through this program will advance the state-of-the-art for tactical and strategic visual displays, removing many existing simulator training limitations and making more efficient use of Air Force manpower and equipment resources.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Begin development of new visual system components. This effort provides a demonstration of the improved visual display technologies to meet Air Force requirements to significantly improve tactical air combat and mission training capabilities. Improvements apply to both air-to-air combat and air-to-surface weapons delivery training. These advanced techniques will provide improved resolution and increased brightness that combat pilots say are a must. These developments will reduce the weight and complexity of visual displays compared to current systems such as the Advanced Simulator for Pilot Training located at Williams Air Force Base AZ. Improved techniques for producing computer-generated visual images will be developed, allowing more efficient and effective use of computer capabilities. The cost estimates were derived using analogous contract manhours, material, and overhead charges adjusted for program complexity, risk and inflation.

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Program Element: #63227F

DOD Mission Area: Environmental and Life Sciences (ATD), #552 Title: Advanced Simulator Technology Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	2,000	3,200	4,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

(264)

Project: #2363

Program Element: #63227F

DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Advanced Visual Technology System

Title: Advanced Simulator Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The program supports the Air Combat Tactics Training thrust of the Air Force Human Resources Laboratory. It provides for the development and demonstration of simulation devices for improved attack aircraft simulators. Project 2363 will fund developments in visual display optics and image projection and in computer image generation technology. Significant visual display projection improvements, especially in image resolution and brightness, will be possible with the development of light-valve projector technology, which will also be able to display multiple, high-resolution targets across the entire visual scene. This capability will eliminate the predicted need to develop complex add-on simulator subsystems that track head or eye movement and display high-resolution targets in the designated, small field-of-view area where the pilot is looking. Substantial improvements will be provided in computer-generated scene quality, including advances in scene detail and update rate and reductions in scene distortion. These improvements will result from advances in edge-oriented computer image generation technology to produce a highly detailed display. The simulation technology advancements funded and managed by this program element will accelerate the state-of-the-art for tactical air combat visual displays, and provide simulator subsystems to train improved air combat readiness.

(U) RELATED ACTIVITIES: Related program elements: 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; 63751F, Innovations in Education and Training, 64227F, Flight Simulator Development, 63738A, Non-Systems Device Development; and 63720N, Education and Training. Both at the working and headquarters levels, there is continuing interface and close coordination among the Army, Navy, and Air Force on simulation for training purposes. The Air Force Human Resources Laboratory, as Air Force Systems Command laboratory focal point for training simulation technology, closely monitors all significant research and development being conducted by other Department of Defense, National Aeronautics and Space Administration, and industrial organizations to eliminate redundancy. Major interservice cooperative efforts include two jointly funded efforts. The first is with the United States Army/Program Manager for Training Devices to develop a General Electric oil bath light-valve projector. The second is to develop improved silicon light-valve projector technology with the Naval Training and Equipment Center.

(U) WORK PERFORMED BY: The program is performed by the Air Force Human Resources Laboratory through the Operations Training Division, Williams Air Force Base AZ. Major contractors are: Hughes Aircraft Company, Fullerton CA; General Electric Company, Daytona Beach FL; Sodern, France.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Two developments in optics were accomplished. First, a prototype color holographic lens to replace currently used glass beamsplitters was demonstrated. This technology provides substantial size and weight savings with no loss in image clarity. Second, a wide field-of-view refractive optics system was developed for large-cabin simulators. This system provides advances in refractive optics by reducing image and color distortion, and enlarging the viewing volume. Two noteworthy advances in image projection technology were also developed. A color liquid-crystal light-valve projector was completed and is serving as a demonstration of progress in light-valve projector technology. Although this medium-resolution demonstration device has no high-resolution or moving target capability, further advancements are planned which would enable light-valve projector technology to serve as the projection device for operational Air Force fighter/attack training simulators. Two 2-inch breadboard demonstration projectors were completed. Each device illustrated a different approach to the light-valve projection concept for providing

Project # 2363

Program Element: # 63227F

DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Advanced Visual Technology System

Title: Advanced Simulator Technology

Budget Activity: Advanced Technology Development #2

higher brightness and higher resolution displays. System design specifications for the 2363 prototype image generator were completed, and algorithms were developed and tested for displaying true curved lines in complex computer-generated visual scenes.

2. (U) FY 1981 Program: A 2-inch silicon crystal light valve will be developed with a high-resolution design goal of 100 lines per millimeter. The projector incorporating this device will use advanced electronics to insert a high-resolution target into the scene. Hardware and software components for a highly improved image generator will be fabricated. These programs will enable the Air Force to train air-to-air and air-to-ground combat tactics in a dynamic simulator combat environment. This environment will provide a totally unique and valuable training situation, not present in any existing training facility or program.

3. (U) FY 1982 Planned Program: Newly developed concepts to improve the efficiency of current computer image generation techniques will undergo an in-depth program review to determine their compatibility before they are integrated into an improved image generation system. These simulation technology advances will significantly expand tactical combat simulator capabilities. They provide the foundation for a complex air-to-air and air-to-ground simulated tactical combat environment able to display the visual cues required to train weapons delivery against specific simulated enemy targets and threats. This work will be completed in FY 1984. The FY 1982 budget was reduced from \$4.500 million to \$3.242 million in order to provide funding needed for other high-priority efforts. DoD then further reduced it to \$2.200 million because of perceived delayed expenditures in FY 1980.

4. (U) FY 1983 Planned Program: The assembly of components for an advanced prototype projector and the development of improved, more flexible edge-oriented techniques for computer-generated images will be continued in preparation for the integration of these technologies.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63245F

Title: Advanced Fighter Technology Integration (AFTI)
 Budget Activity: Advanced Technology Development, #2

DOD Mission Area: Engineering Technology (ATD), #553

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,200	10,400	12,100	12,900	Continuing	Not applicable
2061	Fighter Attack Technology (AFTI/F-16)	3,400	3,500	6,000	4,700		
2568	Mission Adaptive Wing (AFTI/F-111)	5,800	6,900	6,000	5,300		
2682	Advanced Survivable Fighter Technology			100	2,900		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop and demonstrate in flight, separately, and in combination, advanced aeronautical technologies that can substantially enhance the combat potential and improve the survivability of our future military fighter/attack aircraft. Project 2061 flight tests technologies developed under PG 63205F, on the Advanced Fighter Technology Integration F-16 test vehicle. Testing several technologies on the same test vehicle reduces costs and facilitates the integration of these technologies. Project 2568 will develop and demonstrate in flight the smooth skin variable camber Mission Adaptive Wing concept on an F-111 test vehicle. Project 2682 will develop propulsive lift/Short Takeoff and Landing (STOL) integration addressing the need for future fighter aircraft to operate from damaged runways. The selection of technologies is carefully weighed in each case to provide maximum benefit and relevance for the selected technologies.

(U) BASIS FOR FY 1982 RDT&E REQUEST: A new project, Advanced Survivable Fighter, is planned to start in FY 1982. This project will develop propulsive lift, thrust vectoring/thrust reversing two dimensional nozzle, rough/soft field landing gear system and other STOL related technology options for future Short Takeoff and Landing fighter aircraft. The program addresses the serious runway denial problem facing future tactical aircraft at forward bases. The Mission Adaptive Wing will begin flight testing in FY 1982 demonstrating mission flexibility for future military aircraft. Flight testing of the Advanced Fighter Technology Integration F-16 equipped with a Digital Flight Control system and forward canards providing independent six degree-of-freedom flight control will be completed in FY 1982. The Digital Flight Control system provides a selection of task-tailored control laws for optimum aircraft performance in a variety of missions. The aircraft will then be modified with the Integrated Flight/Fire Control III system to demonstrate enhanced combat effectiveness and greater survivability. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk and inflation.

Program Element: #63245F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
TOTAL FOR PROGRAM ELEMENT	9,200	10,400	10,300	Continuing	Not applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63245F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Exploratory development efforts performed during past years have identified a number of promising aeronautical technologies that offer large improvements in capability and survivability over current fighter systems. In order to provide systems developers the assurance needed to build tactical combat aircraft using these advanced technologies, it is necessary that they first be validated in flight. The Advanced Fighter Technology Integration (AFTI) program will develop and demonstrate in flight selected technologies identified in these exploratory development efforts. These technologies include independent six degree-of-freedom control coupled with the versatile Digital Flight Control System, Integrated Flight/Fire Control system, an advanced pilot/vehicle interface to reduce pilot workload and a smooth skin variable camber wing (Mission Adaptive Wing) for mission versatility. Thrust vectoring, advanced high lift systems, and other technologies applicable to Short Takeoff and Landing concepts will be developed and validated in this program.

(U) RELATED ACTIVITIES: This program is flight testing on the Advanced Fighter Technology Integration (AFTI) F-16 test vehicle the Digital Flight Control System and Integrated Flight/Fire Control III system developed under PE 63205F, Flight Vehicle Technology. The AFTI program is related to PE 63242F, Combat Aircraft Prototype (CAP). The AFTI program develops and validates technology items on a demonstrator aircraft. The CAP program draws on the items developed by AFTI in designing solutions to task capability improvements relevant to mission needs. The AFTI program is a joint program with the National Aeronautics and Space Administration and is managed under an approved Memorandum of Understanding. The Digital Flight Control System development in project 2061 is jointly funded by the Navy.

(U) WORK PERFORMED BY: This program is managed by the Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. Contractors are General Dynamics Corporation, Ft. Worth, TX for project 2061; and The Boeing Company, Seattle, WA for project 2568. Flight testing for both projects will be performed jointly by Dryden Flight Test Center and the Air Force Flight Test Center at Edwards Air Force Base, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Project 2061. Detail design of the Digital Flight Control System for the F-16 test vehicle, including the software, was complete by the end of FY 1980. Software coding is approximately 70% complete. The flight control laws were evaluated on the General Dynamics simulator in late FY 1980. The System Design Review (SDR) on the Integrated Flight/Fire Control III development was held during November 1980. Project 2568. Preliminary design on the Mission Adaptive Wing was completed and detail design initiated in late FY 1980.
2. (U) FY 1981 Program: The Digital Flight Control System, direct side force control, direct lift control, and weapon line pointing features will all begin flight testing on the F-16 test vehicle in late FY 1981. Fabrication of the Integrated Flight/Fire Control III system will begin in late FY 1981 for integration on the F-16 test vehicle in late FY 1982. Fabrication of the variable camber Mission Adaptive Wing will begin on the supercritical wing box of the transonic aircraft technology F-111 in mid-FY 1981.
3. (U) FY 1982 Planned Program: A new project, Advanced Survivable Fighter, is planned to start in FY 1982. This program will develop propulsive lift technology options for a future Short Takeoff and Landing fighter for use on battle

Program Element: #63245F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Fighter Technology Integration (AFTI)

Budget Activity: Advanced Technology Development, #2

damaged airfields or austere forward bases. The program addresses the serious runway denial problem that our future tactical aircraft will encounter at forward bases. Flight testing of the Mission Adaptive Wing in a manual control mode will begin in late FY 1982. The flight test is expected to demonstrate a 20-30% improvement in range/fuel consumption over that shown by the unmodified test aircraft. Development of the automatic flight control system for the Mission Adaptive Wing will continue through FY 1982. Phase I flight testing of the F-16 test vehicle modified with the Digital Flight Control System, additional control surfaces for independent six degree-of-freedom control, and advanced pilot/vehicle interface displays will be complete in late FY 1982. The aircraft will then be modified with the Integrated Flight/Fire Control III system and Phase II flight testing of the total integrated system will resume in early FY 1983. The increase in FY 1982 funding for project 2061 is due to the increased contractor support costs for maintenance of the nonproduction Advanced Fighter Technology Integration F-16 test vehicle. The increase in FY 1982 funds for project 2061 was partly offset by a decrease in FY 1982 funds for project 2682. The increase in funds for project 2568 covers a previously unfunded requirement for the Automatic Flight Control System for the Mission Adaptive Wing.

4. (U) FY 1983 Planned Program: A program developing advanced high lift systems in conjunction with the smooth variable camber wing is being considered as a follow-on for the Mission Adaptive Wing project in FY 1983. Advanced high lift systems will have application in the Long Range Combat Aircraft and Short Takeoff and Landing Aircraft developments. Propulsive lift/short takeoff and landing integration design activity will continue through FY 1983. The Integrated Flight/Fire Control III flight testing will begin in early FY 1983 and end in late FY 1983. Flight testing of the manually operated Mission Adaptive Wing will end in late FY 1983. Design, modification, and installation of the automatic variable camber system will be completed in late FY 1983 and flight testing of the automatic system will be initiated.

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not applicable.

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Project: #2061

Program Element: #63245F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Fighter Attack Technology (AFTI/F-16)

Title: Advanced Fighter Technology Integration (AFTI)

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project develops and demonstrates in flight new aeronautical technologies offering improvements in combat effectiveness and survivability over current fighter aircraft. The program demonstrates these technologies, both separately and in combination, on the Advanced Fighter Technology Integration F-16 test vehicle. Technologies to be demonstrated include direct side force control, direct lift control and weapon line pointing using a Digital Flight Control System integrated with a forward canard. This system gives the aircraft independent six degree-of-freedom control capability for increased maneuverability. Other technologies to be integrated and flight tested on the same aircraft include advanced pilot displays and the Integrated Flight/Fire Control III system linking the fire control system to the flight control system of the aircraft. The Integrated Flight/Fire Control System will enable the aircraft to strike a target without flying over it. This will show a multiple improvement in survivability against all threats while maintaining conventional delivery accuracies.

(U) RELATED ACTIVITIES: Project 2061 flight tests technologies developed under PE 63205F, Flight Vehicle Technology, project 2506, Control of Flight. Project 2061 is a joint project with both the National Aeronautics and Space Administration and with the Navy.

(U) WORK PERFORMED BY: This program is managed by the Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The prime contractor for project 2061 is General Dynamics Corporation, Ft. Worth, TX. Flight testing will be performed at Dryden Flight Test Center as part of a joint flight test organization with the Air Force Flight Test Center, Edwards Air Force Base, CA under an approved Statement of Capability.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Wind tunnel tests for the F-16 test vehicle were completed during FY 1980 and Digital Flight Control System fabrication and modification is nearing completion. Software design was completed and 70% coded at the close of FY 1980. A week-long evaluation of the Digital Flight Control System control laws was performed on the General Dynamics simulator in late FY 1980. Source selection is proceeding for tracking sensor to use in the Integrated Flight/Fire Control III (IFFC-III) portion of the program. Simulator results indicate IFFC-III, when coupled with the Digital Flight Control System, will provide several orders of magnitude increase in survivability against ground targets and a 200% increase in firing opportunities in air-to-air combat.
2. (U) FY 1981 Program: Fabrication and modification of the F-16 test vehicle with canards, Digital Flight Control System, and Advanced Pilot/Vehicle Control and Display Interface will be completed in early FY 1981. The aircraft rollout ceremony is scheduled for March 1981. Flight testing will begin in late FY 1981. Integrated Flight/Fire Control III design will continue through FY 1981 with fabrication of the system beginning in late FY 1981.
3. (U) FY 1982 Planned Program: The Advanced Fighter Technology Integration F-16 vehicle will complete phase I flight demonstration of the Digital Flight Control System, six degree-of-freedom flight (direct force control), and the advanced pilot/vehicle interface displays in late FY 1982. The Integrated Flight/Fire Control III system will then be added to the aircraft and flight testing of the integrated system will resume in early FY 1983. The increase in FY 1982 funding for

Project: #2061

Program Element: #63245F

Title: Fighter Attack Technology (AFTI/F-16)

Title: Advanced Fighter Technology Integration (AFTI)
DOD Mission Area: Engineering Technology (ATD), #553
Budget Activity: Advanced Technology Development, #2

project 2061 is due to the increased contractor support costs for maintenance of the nonproduction Advanced Fighter Technology Integration F-16 test vehicle.

4. (U) FY 1983 Planned Program: Flight testing of the Integrated Flight/Fire Control III system will continue throughout FY 1983.

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	3,400	3,500	6,000	4,700	Continuing	Not applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>						
RDT&E Funds	3,400	3,600	4,700		Continuing	Not applicable

Project: #2568

Program Element: #63245F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Mission Adaptive Wing (AFTI/F-111)

Title: Advanced Fighter Technology Integration (AFTI)

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Project 2568 will develop a smooth skin variable camber wing system and flight test the system on an F-111 test aircraft. The wing box on the transonic aircraft technology F-111 test vehicle will be fitted with the variable camber leading and trailing edge wing system. The wing camber may be tailored in flight to achieve peak aerodynamic efficiency for a variety of missions. The development will increase aircraft range and maneuverability and is applicable to fighters, fighter bombers, strategic bombers and possibly airlift aircraft. Initial flight testing will evaluate characteristics of a manual variable camber control system. An automatic flight control system to vary camber as a function of flight condition is being developed and will be evaluated after the manual system trials.

(U) RELATED ACTIVITIES: Project 2568 is a joint program with the National Aeronautics and Space Administration and is managed by a signed Memorandum of Understanding.

(U) WORK PERFORMED BY: This program is managed by the Air Force Flight Dynamics Laboratory, Wright-Patterson Air Force Base, OH. The contractor is the Boeing Company, Seattle, WA. Flight testing will be performed jointly by Dryden Flight Test Center and Air Force Flight Test Center at Edwards Air Force Base, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Preliminary Design Review of the Mission Adaptive Wing was held in late FY 1980 and detail design of the wing was initiated. Design of an Automatic Flight Control System for the variable camber wing continued through FY 1980.
2. (U) FY 1981 Program: Fabrication of the variable camber Mission Adaptive Wing will begin in mid-FY 1981. The supercritical wing box of the transonic aircraft technology F-111 No. 13 will be modified and the variable camber leading and trailing wing edges will be installed. Preliminary design review of the Automatic Flight Control System will be held in mid-FY 1981. Wind tunnel tests on the wing will be completed in early FY 1981. Detail design of the manually operated wing will be completed in mid-FY 1981.
3. (U) FY 1982 Planned Program: Modification of the test F-111 aircraft will be completed and flight testing of the manually operated smooth skin variable camber wing will begin in August 1982. The one year flight test is expected to demonstrate a 20-30% increase in range over the test F-111 prior to modification with the variable camber wing. Detail design of the Automatic Flight Control System will be nearing completion at the end of FY 1982. The increase in FY 1982 funds reflected in the FY 1982 Descriptive Summary cover an unfunded requirement in the development of the Automatic Flight Control System. Integration of the Mission Adaptive Wing with the flight control system in the Automatic Flight Control System is necessary to achieve the optimum camber at each flight condition in order to realize the full potential of the variable camber wing.
4. (U) FY 1983 Planned Program: Initiate a program developing advanced high lift systems in conjunction with the Mission Adaptive Wing. Complete flight testing of the manually operated Mission Adaptive Wing in late FY 1983. Complete design, modification, and installation of the Automatic Flight Control System to begin flight testing in late FY 1983.

Project: #2568

Program Element: #63245F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Mission Adaptive Wing (AFTI/F-111)

Title: Advanced Fighter Technology Integration (AFTI)
Budget Activity: Advanced Technology Development, #2

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E Funds	5,800	6,900	6,000	5,300	Continuing	Not applicable
8. (U) <u>Comparison with FY 1981 Budget Data</u> :						
RDT&E Funds	5,800	6,800	5,200		Continuing	Not applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63246F

Title: Aircraft Subsystems Technology

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	2,715	5,250				Not Applicable
2348	Aircraft Subsystems Technology	2,715	1,750				Not Applicable
2761	On-Board Oxygen Generation Sys	0	3,500				Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element was established to provide for the functional demonstration of aircraft subsystems for both current and future Air Force operational needs. Flight size, flight weight subsystem concepts in the areas of fire protection, lubrication, engine diagnostics, and advanced power systems are designed, fabricated and tested. An On-Board Oxygen Generation System is being tested and evaluated in this program.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program was canceled during the FY 82 budget formulation process due to a lack of FY 1982 funds.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2,600	1,800	3,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #63246F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Subsystems Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides the final proof-of-concept demonstration needed to transition the most promising exploratory subsystems technology into engineering development. The program addresses both current operational deficiencies and the needs of future Air Force systems. It provides a new generation of subsystem hardware for use in weapon systems in many cases supplanting equipment little changed in the last 20 years because low risk alternatives were not available. The resultant hardware will, with engineering development to optimize it for a specific application, be suitable for use in a wide variety of aircraft. Much is suitable for retrofit into aircraft in service or incorporation into those now in production, and all can be applied to future systems. The program will demonstrate superior concepts for: (1) preventing and detecting aircraft fires and for minimizing fire damage; (2) simplifying powerplant design by reducing or eliminating the need for oil lubrication; (3) replacing "maintenance by schedule" with "maintenance when needed" by the use of improved engine diagnostic and health monitoring systems; and (4) generating and distributing electrical and mechanical power aboard aircraft. It provides the mechanism for the methodical application of new subsystems technology to systems at minimum risk to potential users. Investment risk is low, since technical feasibility has been proven in extensive exploratory efforts during the past ten years. The Congress in FY 81 appropriated \$3.5 million to purchase two On-Board Oxygen Generation systems for field tests on a high performance aircraft to be evaluated in both roles of oxygen supply and chemical/biological filtering. The system has potential for providing usable oxygen for the air crew in a chemical/biological environment. The Air Force School of Aerospace Medicine is performing laboratory tests to determine its usefulness in this role.

(U) RELATED ACTIVITIES: Program Element 62203F, Aerospace Propulsion, provides the exploratory development base for the program. Personnel of the Aeronautical Systems Division's Deputy for Engineering will actively participate in all phases of the program, since they are the primary "customer" for its end products. The Air Force Materials, Avionics, and Flight Dynamics Laboratories, Wright-Patterson Air Force Base, OH, will participate in the power distribution efforts, since they represent major power systems users. The latter laboratory will also join in assessing the effectiveness of the hazard protection concepts. Activity in aircraft fire protection will draw upon exploratory efforts of the Federal Aviation Administration, the Navy, and the National Aeronautics and Space Administration. The Navy/Marine Corps has selected an On-Board Oxygen Generation System for the AV-8B as the supplier of oxygen for the pilot. This system would replace the liquid bottled oxygen system now used on most aircraft and simplify the logistic support for the AV-8B. This program serves as a feeder element for Program Element 64212F, Aircraft Equipment Development, and Program Element 64708F, Other Operational Equipment.

(U) WORK PERFORMED BY: The program is managed by the Air Force Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH. Contractors include AiResearch Mfg Co., Torrance, CA (Fuel Tank Inerting System), Bendix Corp., Davenport, IA (Fuel Tank Inerting System), Boeing Co., Seattle WA (Inerting Systems Test) and General Electric Co., Binghamton NY (Electrical Generator).

Program Element: #63246F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Aircraft Subsystems Technology

Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The fire detection system Phase II testing was completed. The Advanced Auxiliary Power Unit was completed. A Turbine Engine Monitoring System for the A-10 was evaluated in flight tests. Efforts were initiated to design, fabricate and demonstrate (a) a self-contained inert gas generator system to protect aircraft fuel tanks from explosions and (b) a permanent magnet variable speed constant frequency power generation system.
2. (U) FY 1981 Program: Two ongoing efforts, the Inert Gas Generator and the Power Generator, will be terminated this year due to lack of FY 1982 funding. These programs will be brought to a close so as to gain the maximum from the effort thus far completed. A two-year program will be initiated to evaluate an on-board oxygen generation system's potential for providing usable oxygen for the air crew in a chemical/biological environment.
3. (U) FY 1982 Program: This program element was zero funded in FY 1982. The project to evaluate an on-board oxygen generation system will be completed this year with FY 1981 funds.
4. (U) FY 1983 Planned Program: None.
5. (U) Program to Completion: This program was canceled.
6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63250F

Title: Lincoln Laboratory

DOD Mission Area: Electronic and Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
TOTAL FOR PROGRAM ELEMENT		19,795	21,500	22,600	24,100		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Lincoln Laboratory Program is a high technology research and development effort conducted through the provisions of a cost reimbursement contract with Massachusetts Institute of Technology. Lincoln Laboratory is operated as a Federal Contract Research Center with manpower control administered by the Department of Defense. The fundamental objective is to maintain a stable technology base in advanced electronics from which military systems may be developed. Utilizing this advanced electronics base, Lincoln actively engages in advanced research, primarily in the area of satellite communications, tactical technology, space surveillance, and radar techniques. Lincoln also provides technical advice and consultation to the military services and defense agencies.

(U) BASIS FOR 1982 RDT&E REQUEST: This request will provide funds for a highly professional staff required to develop and maintain an advanced electronics technology base and conduct advanced research essential to national defense. Satellite communications technology development is planned and is directed toward support of future strategic and tactical satellite communications systems. Space object surveillance and identification technology development and system support efforts are planned to be continued. Planned tactical technology developments include airborne radar for surveillance of ground targets, advanced ground radar techniques, jam-resistant tactical communications and support in applying the technology to developing systems. Research in radar techniques and development of radar system trade-offs is also planned. Budget estimates are based on manpower and material costs for similar, completed projects.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
RDT&E	19,100	21,600	23,900			

(U) OTHER APPROPRIATION FUNDS: Not Applicable

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Program Element: #63250F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Lincoln Laboratory

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: Lincoln Laboratory was established in 1951 by the Air Force with participation by other agencies of the Department of Defense. The primary mission is to conduct research and development pertinent to national defense, with particular emphasis on advanced electronics. The Lincoln program extends from fundamental investigations in science through the development of electronic devices and components to the design, development, and field demonstration of concept models containing the new technology. Lincoln actively engages in advanced research, primarily in the areas of satellite communications, tactical technology, space object surveillance and identification, and radar techniques. Lincoln also provides technical advice and consultation to the military services and defense agencies.

In order to provide policy and program guidance to the management of Lincoln Laboratory, a Joint Advisory Committee has been established. The Commander, Air Force Systems Command, is the Chairman; the Director, Defense Advanced Research Projects Agency, a senior officer from the Army and a senior officer from the Navy are members. The Committee is supported by an Executive Group chaired by the Director of Sciences and Technology, Air Force Systems Command, with members from the Army, Navy, Defense Advanced Research Projects Agency and Defense Communications Agency.

(U) RELATED ACTIVITIES: Additional efforts in the following areas are planned to be funded by the respective program elements. Re-entry systems: 63311F, Advanced Ballistic Re-entry System. Electro-optical devices and systems: 12424F, Spacetrack; 61102F, Defense Research Sciences; 63428F, Space Surveillance Technology. Satellite communications: 33601F, Air Force Satellite Communications System; 33126K, Long-Haul Communications (DCS); 63431F, Space Communications. Sensor collection: 63428F, Space Surveillance Technology; 31022F, Scientific and Technical Intelligence; 31015F, Technical Sensor Collection. Tactical nulling antennas: 64754F, Joint Tactical Information Distribution System; 63727F, Advanced Communications Technology. Speech processing: 33401F, COMSEC; 33126K, Long-Haul Communications System (DCS). Moving target indicator technology: 63747F, Low Visibility Moving Target Acquisition Strike. Precision location strike system: 64742F, Precision Location Strike System. Surface acoustic wave and charged coupled device: 61102F, Defense Research Sciences (Army augmented). Submillimeter technology: 61102F, Defense Research Sciences (Army augmented).

(U) WORK PERFORMED BY: Lincoln Laboratory, Lexington, MA, is operated as a special laboratory of the Massachusetts Institute of Technology under contract with the Air Force and is designated a Federal Contract Research Center. General policy and program guidance is provided by the Joint Advisory Committee in accordance with the provisions of the Department of Defense Plan for Administration of Lincoln Laboratory, dated 27 May 1975. The Joint Advisory Committee is chaired by the Commander, Air Force Systems Command, with senior members from the Army, Navy and the Defense Advanced Research Projects Agency.

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Program Element: #63250F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Lincoln Laboratory

Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Lincoln Laboratory's significant accomplishments include: design of the Semi-Automatic Ground Environment (SAGE) System; development of the Distant Early Warning (DEW) Line and Ballistic Missile Early Warning System (BMEWS) radar technology; design of foliage penetration Moving Target Indicator radars; development and testing of penetration aids for ballistic missile re-entry systems; development and fabrication of Lincoln Experimental Terminals (LET-1 through LET-4) and a series of Lincoln Experimental Satellites (LES-1 through LES-9), including the successful launch of LES-8 and LES-9 which demonstrated advanced military communications technology and system capabilities; the continued development of solid state technology and data systems which have supported the other major programs conducted by Lincoln Laboratory; a study of the use of a Microwave Landing Guidance System for air traffic control; and the development and demonstration of a Lincoln Training System designed to facilitate self-instruction of technical subjects with a potential reduction in the cost of technical training. Tactical technology efforts were continued in millimeter-wave techniques for terminal homing, home-on-jamming techniques, and technology for weapon guidance and control that can operate in a severe jamming environment.
2. (U) FY 1981 Program: Lincoln is continuing efforts in the advanced electronics research area on electro-optical devices such as tunable infrared lasers, infrared imaging devices and high speed photodiode detectors and integrated optical circuits. A submicrometer technology effort is devoted to exploring x-ray lithography techniques for fabricating advanced solid-state devices having dimensions well below 1 micron. Research is also continuing on microwave devices involving both semi-conductor and surface acoustic wave devices, microelectronics and digital integrated circuits for use in such areas as radar signal analysis, speech processing and satellite communications systems. The satellite communication program is developing the technology to permit more effective military communications systems. The current efforts are directed toward a survivable communications technology and on the conceptual design of a general purpose military satellite system. In the radar techniques area, the Multiple-Aperture Surveillance Radar developed to improve detection of slow moving ground targets from a moving aircraft is being demonstrated and evaluated as a candidate for a radar surveillance and strike system. The guidance and control of air-to-surface weapons against mobile targets in a high-threat environment is being investigated. Support to the Ground Electro-Optical Deep Space Surveillance Program and development of advanced electro-optical camera and star/satellite processors will continue.
3. (U) FY 1982 Planned Program: The Laboratory's advanced electronics effort will continue to provide a technology base that supports mission programs and includes advanced development in digital integrated circuits and solid state areas such as electro-optical semiconductor devices, quantum electronics, surface acoustic wave devices, microwave semi-conductor devices and microelectronics. The x-ray lithography techniques for fabricating advanced electronic devices will be continued, as will infrared laser and infrared detector investigations. Technology development will be continued in support of future satellite communications systems. In the space surveillance area, a high-sensitivity electronic image camera using charged coupled device technology will be evaluated. The tactical technology program

Program Element: #63250F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Lincoln Laboratory

Budget Activity: Advanced Technology Development, #2

areas of effort include airborne radar development for surveillance of ground targets, advanced ground radar, jam-resistant guidance and control systems, development of terminal homing techniques based on target signature, jam-resistant tactical communications and support in applying the technology base to developing systems. Various ground moving target detection options and radar system trade-offs will be investigated in the radar techniques area.

4. (U) FY 1983 Planned Program: The advanced electronics technology base efforts in solid state electronics and digital electronics will continue. Satellite communications technology will continue in support of strategic and general purpose satellite communications systems. The tactical technology program will be continued. Advanced radar techniques and technology transfer to developing programs is also planned.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63302F

Title: Advanced Missile Propulsion

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		7,000	8,500	7,300	10,400	Continuing	Not Applicable
2445	Advanced Airbreathing Propulsion	4,000	4,000	2,200	3,300		
6339	Air Launched Missile Propulsion	1,600	1,200	800	1,700		
6340	Space Systems Propulsion	1,000	2,500	2,600	3,000		
6341	Ballistic Systems Propulsion	400	800	1,700	2,400		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The performance, reliability, cost and service life of advanced rockets and airbreathing (ramjet) propulsion concepts will be assessed. Propulsion options to increase payload for space launched and ballistic missiles and increase launch range and/or reduce the intercept flight time of tactical missiles will be demonstrated. The scope of this program includes comprehensive integrated propulsion system testing in sea level and simulated altitude test facilities and flight tests of the ramjet (ducted-rocket) concept.

(U) BASIS FOR THE FY 1982 REQUEST: During this period four tasks will be pursued. The ducted-rocket propulsion concept will provide the Advanced Medium Range Air-to-Air Missile with an option for an extended range variant. For a typical co-altitude, co-speed launch at 10,000 feet and Mach 0.9 the ducted rocket provides 35% more range and 45% reduced time-to-target. Other launch conditions show improvements of up to 100%. During FY 1982, freejet testing of the ducted rocket will be completed and buildup of the six flight test vehicles started. The flight testing will be conducted in PE 63313F, Advanced Missile Subsystems Demonstration. The second task will start the development of boost glide propulsion. This propulsion concept in a 2,000 pound class tactical or strategic missile will provide range increases of up to 100% when flown in a boost-skip trajectory. The third task is directed at applying advanced ballistic missile propulsion technology to the Inertial Upper Stage for the Space Shuttle. This task was started in May 1980 and includes demonstration of advanced propellant, case, and high-area-ratio expandable nozzles for the small Inertial Upper Stage motor. Applying this technology to both Inertial Upper Stage motors would provide a 20% to 30% payload growth. During 1982 the first of three planned full-scale motor tests will be conducted. The fourth task was started in FY 1981 and consists of demonstrating technology that was considered too risky to enter MX engineering development. Use of advanced propellants and inert components will provide a 11% throwweight increase for a block change in MX or an upgrade in Minuteman. The first part of this task is a two-year effort focusing on the propellant. Later efforts will focus on the inert component with the final motor demonstration scheduled for FY 1987. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk and inflation.

Program Element: #63302F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Missile Propulsion

Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	7,000	8,500	9,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Program Element: #63302F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Missile Propulsion

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element evaluates advanced rocket and airbreathing (ramjet) propulsion concepts, and provides for early demonstration and orderly, low-risk transition of these technologies to engineering development of air launched, space and ballistic systems. Emphasis is placed on early assessment of the performance, cost, reliability and service life of propulsion options for growth and/or new systems developments. The concepts validated under this program will provide significantly decreased life cycle cost in addition to a major expansion of mission capability over current operational systems. Demonstration of full-scale flightweight propulsion systems for air launched, space launched, and ballistic rocket systems will be conducted under the most realistic systems oriented conditions. Major production cost savings are expected for rocket systems from the use of new binders, commercially available materials, improved grain design, and improved manufacturing methods and techniques. Improvements in life cycle cost are expected from service life technology which has more closely defined reasonable thermal and mechanical environmental limits. Flight demonstration of the ducted-rocket propulsion concept will provide the class of beyond visual range tactical missiles with higher average speed to target, increased payload capability, longer range, and/or smaller size than systems currently in development. Demonstration of engine performance, missile performance limits, propulsion cost, and engine reliability will be an integral part of this ramjet program. A demonstration effort for a motor in the Advanced Medium Range Air-to-Air Missile size will include reduced smoke propellant to reduce aircraft and missile detectability and the radial-burning-pulse concept to provide for more end-game maneuverability. A space propulsion effort will address the need to improve the payload capability of Air Force space launch vehicles and the opportunity to use technology spin-off from ballistic missiles. High-energy propellants, high-performance nozzles, and lightweight cases will result in greater than 20% payload increase for Space Shuttle launches. Technology in solid propellants and inert components that was considered too high risk to enter MX development will be demonstrated in this program. These technologies, when applied in the third stage, can provide 11% throwweight increase.

(U) RELATED ACTIVITIES: Programs to demonstrate component feasibility and practicality are initially accomplished in exploratory development under Program Element 62302F, Rocket Propulsion, and Program Element 62203F, Aerospace Propulsion. Work on rocket and ramjet propulsion by the services and National Aeronautics and Space Administration is coordinated through the Joint Army-Navy-NASA-Air Force Interagency Propulsion Committee. In addition, the Office of the Under Secretary of Defense for Research and Engineering reviews and coordinates all services' programs through the auspices of the Propulsion Technology, Missiles and Space Vehicles Technology Coordinating Paper. This program element provides technology for the following program elements: PE 63313F, Advanced Missile Subsystems Demonstration; PE 64314F, Advanced Medium Range Air-to-Air Missile; PE 64312F, MX; and PE 64411F, Space Transportation System Acquisition.

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Program Element: #63302F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Advanced Missile Propulsion

Budget Activity: Advanced Technology Development, #2

(U) WORK PERFORMED BY: The Air Force Rocket Propulsion Laboratory, Edwards Air Force Base, CA, is managing the overall program. The Air Force Wright Aeronautical Laboratories, Aero Propulsion Laboratory, Wright-Patterson Air Force Base, OH, is a co-participant and manages the Advanced Airbreathing Propulsion, Project 2445. All work is done under contract. A list of contractors/bidders includes: Hughes Aircraft Company, Canoga Park, CA; Hercules, Incorporated, Cumberland, MD and McGregor, TX; Thiokol Chemical Corporation, Brigham City, UT and Huntsville, AL; Atlantic Research Corporation, Alexandria, VA; Aerojet Solid Rocket Company, Sacramento, CA; and United Technologies Corporation, Sunnyvale, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The first effort under this program element, November 1976 to April 1979, demonstrated an improved satellite orbit transfer motor capable of placing a 170 pound heavier NAVSTAR satellite into proper orbit. In September 1977, Aerojet Manufacturing Company and Rockwell International Corporation were issued competing efforts to demonstrate expulsion/tankage concepts for the MX post-boost propulsion system. The Aerojet Manufacturing Company approach was selected as the MX baseline in FY 1980 and has entered engineering development. Hughes Aircraft Company was issued a contract in September 1978 to demonstrate the fixed-fuel-flow ducted rocket. The ducted-rocket program will be completed in FY 1983 after six flight tests conducted under PE 63313F. Thiokol Corporation was issued a contract in December 1979 to demonstrate technique to lower the production cost of rocket motors by greater than 30%. The first application of these techniques was in the Army's Multiple Launch Rocket System. Hercules, Incorporated was selected in July 1978 to incorporate the radial pulse and reduced smoke propellant concepts into motor designs compatible with the two Advanced Medium Range Air-to-Air Missile prime contractor approaches. These efforts will be completed in FY 1981 and will provide an alternative high-performance propulsion backup for the Advanced Medium Range Air-to-Air Missile engineering development. A contract was issued to Thiokol Corporation in May 1980 to provide technology that will allow payload growth for the Space Shuttle Inertial Upper Stage.

2. (U) FY 1981 Program: During this period the fixed-fuel-flow ducted-rocket engine direct connect testing will be completed. The inlet aerodynamic testing will be completed and the wind tunnel testing of the flight vehicle model, including safe separation of missile from aircraft, will be completed. Preliminary Flight Rating Test of a reduced-smoke two-pulse rocket motor will be completed providing the Advanced Medium Range Air-to-Air Missile with a higher performance propulsion option. The effort incorporating ballistic missile propulsion technology into the small Inertial Upper Stage motor will be continued with the objective of providing greater than 10% payload increase. An effort will be started to provide technology for future versions of MX or Minuteman II replacement. MX technology is providing a 40% payload increase over that available from Minuteman II; however, significant technology gains are still available. This long-term task (planned completion 1987) will provide third-stage technology allowing at least an 11% payload growth or range flexibility. The first effort under this task will focus on demonstrating high-energy propellant and is scheduled to be completed in FY 1982.

Program Element: #63302F

Title: Advanced Missile Propulsion

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

3. (U) FY 1982 Planned Program: Freejet testing of the ducted-rocket engine will be completed. Buildup of the six flight vehicles will be initiated, and the development of a nozzleless booster will be completed. This technology will provide up to a 100% range increase and 45% time-to-target reduction over conventional rocket technology for an Advanced Medium Range Air-to-Air Missile. Due to funding uncertainty in PE 63313F to conduct flight testing of the ducted rocket concept, the Hughes Aircraft Company contract was renegotiated to reduce the number of flight tests from twelve to six and the program schedule stretched. This allows completion of direct-connect testing of the ducted-rocket engine in PE 63302F and maintains the option to conduct flight testing with the funds made available in FY 1981 in PE 63313F. An effort to increase tactical and strategic standoff missile range by up to 100% through use of advanced propulsion combined with the boost-glide (skip trajectory) will be started. Ground testing of these motors will address producibility and reliability, as well as demonstrating the motor's ballistic performance. This effort had been planned for an FY 1981 start. Delaying the start to FY 1982 allows the data being developed under exploratory development on boost-glide to be included in the initial design phase of this effort. The program to provide Interim Upper Stage payload growth of more than 20% will enter motor component testing. Long-lead components for the three full-scale motors scheduled for testing in FY 1983 will be procured. Due to funding constraints, the Advanced Technology Upper Stage Motor effort will be stretched over the period of FY 1981 to FY 1987. The first two years focus only on high-energy propellants with work on inert components scheduled for FY 1983 to FY 1985. The propellant ballistic and mechanical properties will be verified during FY 1982. These properties will include propellant processability, curability, mechanical properties, burning characteristics, hazard classification and aging capability. The propellant and inert componentry (advanced cases, insulation, and nozzle technology) will be combined in full-scale motor tests during the last two years of this effort demonstrating an 11% payload or range flexibility growth for MX block changes or upgrading Minuteman II.

4. (U) FY 1983 Planned Program: The ducted-rocket engine effort will transition to PE 63313F for flight test of the six vehicles in FY 1983. The technology will then be ready to enter engineering development with the potential of meeting Initial Operational Capability as an Advanced Medium Range Air-to-Air Missile variant in the late 1980s. The demonstration of a technology improvement (variable-fuel flow) for the ducted-rocket engine will be started. This technology will add 25% low altitude and 100% high altitude range extension to that achievable with the standard ducted-rocket engine. The testing of boost-glide motors will start. These motors will be for a 2,000 pound class missile and provide the capability for a tactical or strategic missile to reach out to the 300 Nautical mile range using conventional solid rocket motor technology. The demonstration of technology improvements for the small Inertial Upper Stage motor will be completed. An engineering development program would then provide more than 10% payload increase for a Space Shuttle mission in FY 1985. The Advanced Technology Upper Stage effort will move into development of motor inert components. Higher strength Kevlar motor cases and higher performance expandable nozzle/exit cones will be demonstrated. Later efforts will integrate these advanced inert components with the propellant developed in FY 81-82 to demonstrate a motor capable of increasing MX payload by 11%.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63363F
DOD Mission Area: Air Warfare, #355

Title: Hypervelocity Missile Program
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (\$ in thousands):

Project Number	Title	1/		2/		Total Estimated Cost
		FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	
	TOTAL FOR PROGRAM ELEMENT	0	2,000	8,200	900	11,100

1/ In FY 81, program funds are included in PE 63249F.

2/ Transferred from PE 63601F, Conventional Weapons Technology; Project 2718 Hypervelocity Missile.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Hypervelocity Missile is a small, low cost, hypersonic, antivehicular, multiple kill per pass missile. The Armament Division has devised a competitive 24-month program which will culminate with the ground demonstration of multiple weapons being fired and independently guided to multiple targets. This approach to killing armor is affordable and doable. It will allow the U.S. to buy enough anti-armor missiles and carry enough of those missiles per aircraft to make a major dent in any Soviet armor aggression.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This fiscal year's funding will enable dual contractors to accomplish appropriate ground testing of the critical missile technologies such as guidance, warhead penetration and rocket motor sizing.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

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Program Element: #63363F

DOD Mission Area: Air Warfare, #355

Title: Hypervelocity Missile

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Hypervelocity Missile is a fast (Mach 4.0+), small (20-40 lbs), low cost (\$5K or less), anti-vehicular, multiple engagement weapon. It is necessitated by the marked imbalance in armor and air defense capabilities of the Warsaw Pact vis-a-vis the North Atlantic Treaty Organization. This missile represents a completely different approach to killing armor than is used by current weapons such as MAVERICK, HELLFIRE, and TOW. It uses a kinetic energy penetrator (rod and/or tube) instead of a chemical energy warhead, as the kill mechanism. Thus it achieves a substantial reduction in missile size, weight and cost while dramatically increasing the missile's flight velocity and aircraft combat load. These characteristics provide a marked increase in firepower per sortie while simultaneously decreasing the aircraft's exposure time. The potentially high payoff of the Hypervelocity missile is that it will enable the U.S. Forces to dramatically increase the weapons available and the armament carried per sortie. Additionally, the low cost per missile combined with its simple employment procedures will enable the tactical forces to train our aircrews to effectively use these munitions.

(U) RELATED ACTIVITIES: The Multifunctional Infrared Coherent Optical Scanner (MICOS) program (PE 62204) initiated the CO2 Scanner development required for this missile. This effort is transferred to this program element in FY 82.

(U) WORK PERFORMED BY: The Armanent Division (AFSC) Eglin AFB, FL

(U) PROGRAM ACCOMPLISHED AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This is an FY 81 new start program
2. (U) FY 1981 Program: Two contractors will be selected for a competitive 24 month program. The design of the missile will be initiated
3. (U) FY 1982 Planned Program: The missile's subsystems will be tested and validated. The MICOS program is transferred to this program element.
4. (U) FY 1983 Planned Program: Ground demonstration of multiple missiles being ripple launched and subsequently simultaneously and independently guided to multiple targets. This demonstration will validate the missile's guidance concept and kill mechanism.
5. (U) Program to Completion: Not applicable
6. (U) Milestones: Not Applicable

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

PROGRAM ELEMENT: #63452F (62704F)

TITLE: Very High Speed Integrated Circuits

DOD MISSION AREA: Electronic & Physical Sciences
(ED), #521

BUDGET ACTIVITY: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT	28,431*	26,600*	41,500	42,500	78,600	217,631

* Program Element 62704F. The work transitions to Program Element 63452F in Fiscal Year 1982.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Tri-Service program develops two generations of very high speed integrated circuits suitable for introduction into military systems on an accelerated basis. The major applications of these integrated circuits will be digital signal processing for radar, electronic countermeasures, communications, missile navigation and guidance, anti-submarine warfare, and infrared image sensor systems. This program is essential because commercial applications for integrated circuits do not require the speed, do not have the signal processing orientation, and are not designed to operate in a military environment. Funds for the entire Very High Speed Integrated Circuits program were placed in this Air Force program element by Congressional direction, but program execution is under control of the program office in the Office of the Under Secretary of Defense for Research and Engineering.

(U) BASIS FOR THE FY 1982 RDT&E REQUEST: Provides funds for design, fabrication process development, and initial testing of first generation very high speed integrated circuit chips. These very high speed integrated circuits are intended for rapid insertion into military systems to increase their capabilities and reliability and reduce their life cycle costs. Examples of present deficiencies are inability of radars, thermal imagers and acoustic sensors to automatically classify targets; saturation of warning receivers and countermeasure power management systems in dense signal environments; and lack of small, inexpensive secure voice communications terminals. Funds long lead time development of second generation (submicrometer feature size) integrated circuit technology such as computer aided design and layout software and equipment for making circuit patterns beyond the capability of optical lithography equipment. The second generation very high speed integrated circuits are necessary to support signal processing requirements of military systems of the 1990s. Examples are signal processors for high resolution airborne attack radar, fire and forget missiles, electronic warfare threat warning and power management, image sensors, automatic target classification and cueing, acoustic sensor nets, and communication nets. The cost estimate was the result of consultation among technical and cost experts in the three services and the Office of the Under Secretary of Defense for Research and Engineering. However, these figures are currently under review.

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PROGRAM ELEMENT: #63452F (62704F)

MOD MISSION AREA: Electronics & Physical Sciences,
(ED), #521

TITLE: Very High Speed Integrated Circuits
BUDGET ACTIVITY: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	30,430*	34,251*	41,138		107,036	212,855

*Program Element 62704F. The work transitions to Program Element 63452 in Fiscal Year 1982.

(U) OTHER APPROPRIATION FUNDS:

Not Applicable.

PROGRAM ELEMENT: #63452F (62704F)

DOD MISSION AREA: Electronics & Physical Sciences
(ED), #521

TITLE: Very High Speed Integrated Circuits
BUDGET ACTIVITY: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The Very High Speed Integrated Circuit program was begun: (1) to prevent erosion of our lead over our adversaries in the keystone area of integrated circuit technology, (2) to meet military specific requirements for integrated circuits not being met by commercial integrated circuit market pressures. These requirements include high speed signal processing applications for radar, electronic warfare, imagery sensors, communications, missile navigation and guidance, and acoustic sensors. The requirements further include the abilities to survive and operate over the military temperature range (-55 degrees Celsius to 125 degrees Celsius) and in radiation environments. The overall objective is to develop two generations of very high speed integrated circuits through pilot production line capability for rapid use in military systems. The program is structured in four parts. The Definition Phase is a nine month effort which has considered the following areas: (1) chip set architecture (to designate functional chips usable in a wide variety of applications), (2) computer aided design system definition, (3) device design and modelling, (4) fabrication process development, (5) requirements for circuit patterning equipment, (6) requirements for chip testing equipment, (7) requirements and strategy for fault tolerance and on-chip test (8) initial design of first generation very high speed integrated circuit demonstration subsystems. Phase I is a three year effort to: (1) develop the first generation very high speed integrated circuit chips (1.25 micrometer minimum feature size) to the pilot production line stage together with the architecture, design and fabrication of these chips and the demonstration brassboards for demonstration of very high speed integrated circuit capabilities, (2) develop second generation very high speed integrated circuit technology for chips having minimum feature sizes of 0.5 to 0.8 micrometers (about one-thousandth the diameter of the period at the end of this sentence) to demonstrate second generation feasibility. Long lead time major items for second generation very high speed integrated circuit are computer aided design software, non-optical patterning equipment, and fabrication process development. Phase II will be a two year effort to (1) test and evaluate the first generation very high speed integrated circuit demonstration subsystems, and (2) complete second generation very high speed integrated circuit sets through pilot production line capability. Phase III is the technology support work. It is a six year effort which runs concurrently with and supports the Definition Phase, Phase I, and Phase II. The technology support work consists of a number of independent efforts with the intent of (1) providing innovative ideas which can make very high speed integrated circuits even more productive and (2) filling gaps and reducing risk in Phase I and II efforts. Innovative architecture and computer aided design approaches, critical aspects of fabrication processing, and tester development are examples of areas being pursued.

(U) RELATED ACTIVITIES: This is a Tri-Service program with oversight executed by the Office of the Under Secretary of Defense, Research and Engineering. The Program Director is in the Office of the Under Secretary of Defense, Research and Engineering and coordinates the work within the program and work related to it. The Services, the Defense Advanced Research Projects Agency, the Defense Nuclear Agency and the National Security Agency are represented on the Very High Speed Integrated Circuit Executive Committee chaired by the Office of the Under Secretary of Defense, Research and Engineering (Research and Advanced Technology) which met four times in Fiscal Year 1980 to set policy and review progress. Related activities include: Aircraft Avionics, (PE #62202A); Electronic and Electron Devices (PE #62705A); Electron Device Technology (PE #62762N); Aerospace Avionics, (PE #62204F); Aircraft Avionics Equipment, (PE #63207A); Avionics, (PE #63202N); Advanced Electron Device Development, (PE #63742N); Advanced Avionics for Aircraft, (PE #63203F); and Electronic Warfare Technology, (PE #63718F).

PROGRAM ELEMENT: #63452F (62704F)

DOD Mission Area: Electronics & Physical Sciences
(ED), #521

TITLE: Very High Speed Integrated Circuits

BUDGET ACTIVITY: Advanced Technology Development, #2

(U) WORK PERFORMED BY: The Office of the Under Secretary of Defense for Research and Engineering executes program management of Very High Speed Integrated Circuits. Air Force Wright Aeronautical Laboratory, Wright-Patterson Air Force Base OH, administers the work performed under the Very High Speed Integrated Circuits program. The work is monitored in the following organizations: Electronic Technology and Device Laboratories, Electronic Warfare Laboratory, and Communications Research and Development Command, all of Fort Monmouth NJ; Army Missile Command, Huntsville AL; Army Armament Research and Development Command, Dover NJ; Army Night Vision and Electro-Optics Laboratory, Fort Belvoir VA; Army Research Office, Research Triangle Park NC; Naval Electronic Systems Command, Naval Research Laboratories, both in Washington DC; Office of Naval Research, Arlington VA; Naval Air Development Center, Warminster PA; Naval Surface Weapons Center, Dahlgren VA and White Oak MD; Naval Weapons Center, China Lake CA; Naval Ocean Systems Center, San Diego CA; Air Force Wright Aeronautical Laboratories, Wright-Patterson Air Force Base OH; and Rome Air Development Center, Griffiss Air Force Base NY and Hanscom Air Force Base MA. The top ten contractors were Hughes Aircraft Corporation, Malibu and Culver City CA; Varian, Beverly MA; Texas Instruments, Dallas TX; TRW, Redondo Beach CA; University of Illinois, Urbana IL; Westinghouse, Baltimore MD; Rockwell International, Anaheim CA; Perkin Elmer, Norwalk CT; Honeywell Inc., Minneapolis MN; and Raytheon, Bedford MA. In addition, there were 15 contractors located nationwide with 23 contracts. In all there were 56 contracts. This includes the work on the Definition Phase and the Technology Support Phase (Phase III).

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Nine parallel Definition Phase contracts began with the objectives of defining in detail the work to be done in Phase I and gathering preliminary data to show the feasibility of the Phase I work. Forty-eight Technology Support (Phase III) contracts began. Some of these efforts reduce risk in areas critical to program success. Other efforts provide innovative ideas in specific areas not available from the nine Definition Phase contractor teams. Examples of such work follow. Various aspects of non-optical patterning techniques such as electron beam and ion beam lithography are being explored. Such techniques and equipment are necessary to make the second generation circuits, which will have features smaller than can be defined by conventional optics. This feature size capability is necessary to make the circuits run fast enough and consume sufficiently lower power to do the signal processing tasks for the military applications planned. Several aspects of computer aided design are being developed to handle the process of designing highly complex chips so they will perform the functions intended, will be testable, and will be reliable. Fabrication process techniques compatible with the new lithography and the ultrafine dimensions are being developed to make the very high speed integrated chips more producible and to increase their performance and survivability in military environments.
2. (U) FY 1981 Program: Phase I begins (this is the first year of a three-year effort). Detailed design begins on demonstration subsystems selected and the first generation very high speed integrated circuits chip sets to be used in them. The chip sets will be designed so that individual chips will be usable in multiple applications with little additional design cost. Fabrication process development will address issues of reproducibility, circuit operation over the full military temperature range (-55 degrees Celsius to 125 degrees Celsius) and operation in the presence of radiation.

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PROGRAM ELEMENT: #63452F (62704F)

DOD MISSION AREA: Electronics & Physical Sciences
(ED), #521

TITLE: Very High Speed Integrated Circuits
BUDGET ACTIVITY: Advanced Technology Development, #2

Work will begin on computer aided design software to support the high level of complexity expected for the second generation chips (about 100,00 logic gates on a chip of silicon one-quarter inch square). Development of the electron beam lithography machine begins. This machine will write circuit patterns with feature sizes as small as 0.5 micrometer (and registration accuracy to 0.1 micrometer) on the Very High Speed Integrated Circuit chips with a chip throughput sufficient to produce pilot production quantities. Early results from the Technology Support efforts will be fed into the Phase I work reducing its risk.

3. (U) FY 1982 Planned Program: New Technology Support efforts will begin in any areas where technology barriers still exist or where additional risk reduction is required. The output of these new efforts as well as the output of the ongoing efforts will be used in the Phase I program. In Phase I, work will begin on the first generation very high speed integrated circuit pilot production lines. Work will be completed on demonstration subsystem partitioning and first generation chip designs. This will insure that the chip sets designed will be useful in more subsystems than the ones demonstrated and that the demonstration subsystems make maximum use of the first generation chips. Since the design cost of integrated circuits is high, the strategy will be to design chips whose functions can be used in many types of systems without modification and to have other chips which can be modified at low cost. First generation fabrication process validation (by testing test chips) will begin. Work will continue on long lead time problems associated with second generation very high speed integrated circuits. Examples are the computer-aided design software necessary to handle the complexity of the second generation chips, accurately model the devices on them, and insure testability is designed in. Development of the electron beam lithography machine (capable of high chip throughput and minimum feature size patterning as small as 0.5 micrometer) will continue.
4. (U) FY 1983 Planned Program: Pilot line production of first generation very high speed integrated circuits begins. Chip designs will be frozen and initial chips evaluated. Support software for the demonstration brassboards will be completed. Second generation fabrication processes will be validated using test chips with 0.5 - 0.8 micrometer feature sizes. Most of the Technology Support work will be complete and the results integrated into Phase I to enhance the transition to second generation very high speed integrated circuit chips.
5. (U) Program to Completion: In FY 1984 Phase I will be complete. Demonstration subsystems using first generation very high speed integrated circuits will be delivered. Phase II will begin. In this phase the first generation brassboard subsystems will be tested and evaluated for insertion in systems. At the same time work will continue on the second generation very high speed integrated circuits. Computer aided design software will be complete and chip designs frozen. The electron beam lithography system with pilot line production throughput capability will be completed. Pilot line production of second generation chips will start. Chip testing and evaluation will be completed and the second generation very high speed integrated circuits will be ready for use in systems.

PROGRAM ELEMENT: #63452F (62704F)

DOD MISSION AREA: Electronics & Physical Sciences
(ED), #521

TITLE: Very High Speed Integrated Circuits

RUDGET ACTIVITY: Advanced Technology Development, #2

6. (U) Milestones:

		<u>Date:</u>
A. Complete Program Definition	*(4th quarter FY 1980)	1st quarter FY 1981
B. Begin Phase I	*(1st quarter FY 1981)	3rd quarter FY 1981
C. Complete First Generation Chip Architecture	*(3rd quarter FY 1981)	1st quarter FY 1982
D. Begin First Generation Pilot Production Line	*(3rd quarter FY 1982)	4th quarter FY 1982
E. Complete Phase I		3rd quarter FY 1984
F. Begin Phase II		4th quarter FY 1984
G. Complete Phase II		4th quarter FY 1986

* Date presented in Fiscal Year 1981 Descriptive Summary

(U) EXPLANATION OF MILESTONE CHANGES: The start (and therefore the end) of the Definition Phase was delayed due to an extended proposal evaluation and negotiations with contractors. The forecast date for the start of Phase I has likewise been modified to reflect this experience. The change in the Phase I start date has caused the other dates to change.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63601P

Title: Conventional Weapons Technology

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): (\$ In thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		21,750	21,452	23,300	20,900	Continuing	Not Applicable
670A	Ordnance Technology	3,834	4,033	4,900	4,300	Continuing	Not Applicable
670B	Air-to-Surface Guided Weapons Technology	13,206	12,297	13,400	11,900	Continuing	Not Applicable
670E	Air-to-Air Technology	2,197	3,856	3,100	2,500	Continuing	Not Applicable
670F	Aircraft Gun Technology	1,513	1,266	1,900	2,200	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Includes Air Force advanced development effort for technology base demonstrations of advanced non-nuclear aircraft armament and weapons guidance technology. New weapons concepts and technology applications are developed and tested to demonstrate feasibility, effectiveness and operational potential. This program serves as the basis for follow-on system development and advanced prototyping programs. Cost estimates are based on currently contracted efforts and laboratory estimated level of efforts for work outlined in this Descriptive Summary.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This is the only Conventional Weapon Technology (6.3) program within the Air Force. It is a many-faceted, broad scoped program which will: (1) continue conventional weapons development, initiated in FY 1981 and prior years such as Low Altitude Dispenser, Infrared and Millimeter Wave guidance demonstration, and (2) initiate promising new technology demonstrations such as the Joint Service Synthetic Aperture Radar Guidance demonstration which appears to offer a guidance option for increased capability to destroy high value targets; and (3) Tactical Global Positioning System demonstration which will provide low cost guidance for conventional cruise missiles. Funding requirements derived from currently contracted commitments, historical data, and laboratory cost models.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	21,000	23,500	24,900		Continuing	Not Applicable

FY 1981/FY 1982 funding differences are for the reduction in scope of Aircraft Gun Technology efforts.

Program Element: #63601F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology

Budget Activity: Advanced Technology Development, #2

(U) OTHER APPROPRIATION FUNDS: Not Applicable

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to apply state-of-the-art technology to the development of non-nuclear weapons. These developments are driven by a broad range of tactical and strategic requirements for new and improved non-nuclear weapons. All aspects of conventional weapons are included in the program: bomb/missile warheads, fuzing systems, aircraft/stores interface equipment, adverse weather air-to-surface and air-to-air seekers, gun mechanisms, ammunition and propellants. In addition, promising foreign technology is evaluated for possible application to US requirements. This program element is the only Air Force advanced development effort for conventional weapons technology which forms the basis for follow-on engineering development programs to demonstrate advancement in the state-of-the-art.

(U) RELATED ACTIVITIES: This program demonstrates non-nuclear technology advances initially investigated in Air Force exploratory development Conventional Munitions (PE 62602F), Aerospace Avionics (PE 62204F) and Rocket Propulsion (PE 62302F) programs. Coordination is maintained with Advanced Avionics for Aircraft (PE 63203F), Digital Avionics Information System (PE 63243F) and NAVSTAR/Global Positioning System (PE 64778F) programs. Outputs from this program are to: The Advanced Missile Subsystem Demonstration (PE 63313F), Advanced Short Range Air-to-Air Missile Technology (PE 63380F), Advanced Medium Range Air-to-Air Missile (AMRAAM) (PE 63370F/64416F), Advanced Attack Weapons (PE 63609F), Armament/Ordnance Development (PE 64602F), Close Air Support Weapons System (PE 644608F), Air Delivered Land Mines (PE 64610F), and Surface Defense Suppression (PE 64733F) programs. Tri-Service coordination is accomplished through the Joint Technical Coordinating Group (JTCG) for Munitions Development, the JTCG for Munitions Effectiveness and the Joint Service Guidance and Control Committee for guidance and control activities. Other joint specialized committees have been formed for specific technology sub-areas. Jointly funded/sponsored tasks in this program include Standard Store Interface and the Ring Laser Gyro programs and the demonstration of Millimeter Wave/Synthetic Aperture Radar seeker technology on Adverse Weather Seekers. International cooperation and coordination is effected under the auspices of The Technical Cooperation Program and various specific country-to-country data exchange agreements, such as the NATO infrared and millimeter wave target/background signature measurement program.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin Air Force Base, Florida is the responsible technical activity for this program. Test facilities at the Armament Division, Eglin Air Force Base, Florida; the Arnold Engineer Development Center, Arnold Air Force Station, TN; and the Central Inertial Guidance Test Facility, Holloman Air Force Base, NM support this program. Major contractors on this program are: Brunswick, Costa Mesa, CA; McDonnell Douglas, Huntington Beach, CA; General Dynamics Corporation, Pomona, CA; Texas Instruments, Dallas, TX; Honeywell Inc., Minneapolis, MN; Hughes Aircraft Company, Canoga Park, CA; Martin Marietta, Orlando, FL; Teledyne Systems Company Northridge CA; Lear Seigler, Grand Rapids, MI; SRI International, Menlo Park, CA; Motorola, Scottsdale, AZ; Ford Aerospace, Newport Beach, CA. Eighteen other contractors and non-Air Force Government activities hold additional contracts.

Program Element: #63601F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Most of the new conventional ordnance in the Air Force inventory or currently in acquisition programs was initially demonstrated under this program. The most significant FY 1980 accomplishments in the areas of ordnance, air-to-surface guided weapons, air-to-air weapons and aircraft gun technologies are as follows:
 - (U) Ordnance Technology: (1) A baseline Aircraft/Store Electrical Interface Standard (MIL-STD-1760) which will form all future Air Force/Navy/NATO store interface specifications was developed; and (2) The Integrated Digital Stores Management System which provides the aircrew real-time status of aircraft stores was developed and successfully flight tested.
 - (U) Air-to-Surface Guided Weapon Technology: (1) A Joint US/German millimeter-wave and infrared measurement program which compiled vast amounts of background and armored threat target data was successfully completed. A total of 30 vehicles' signatures was obtained under various passive decoys and countermeasure techniques; (2) The ability to single out a specific Ultra High Frequency emitter in a field of numerous similar emitters was demonstrated. This breakthrough provides for the exploitation of targets such as continuous wave jammers, communication systems and communication jammer systems which have not been previously available; (3) The feasibility of a Tactical Global Positioning System for midcourse guidance was demonstrated. A Tactical Global Positioning System receiver/processor was successfully test flown in a pod on an F-4 to simulate tactical subsonic missile dynamics in a jamming environment; and (4) A Low Altitude Dispenser System concept which will provide short range standoff and off-axis trajectory capability was validated in wind tunnel testing.
 - (U) Air-to-Air Technology: An air-to-air, active laser seeker designed without physical constraints was developed and successfully tested. This short range air-to-air seeker may provide a unique guidance option for the next generation short-range missile development.
 - (U) Aircraft Gun Technology: A 30 millimeter projectile concept was formulated for defeating advanced armor by using a high density metal and increased length to diameter ratio of the penetrator. These improvements provide full kinetic energy projectiles with higher velocities.
2. (U) FY 1981 Program: The FY 1981 program is emphasizing the technology for weapons developments geared to the needs defined by user requirements for non-nuclear conflicts in Europe and the Middle East. Specific major efforts by project tasks are as follows:
 - (U) Ordnance Technology: (1) Validate the Standard Stores Interface specification (MIL-STD-1760) for use with current

Program Element: #63601F

Title: Conventional Weapons Technology

DOD Mission Area: Engineering Technology (ATD), #553

Budget Activity: Advanced Technology Development, #2

and future aircraft/stores interfaces for Air Force/Navy/NATO weapon systems; and (2) development of the Low Altitude Dispenser through free flight testing that demonstrates the ability to achieve required terminal orientation and provide safe escape of delivery aircraft will continue.

(U) Air-to-Surface Guided Weapon Technology: (1) Continue data collection and analysis of millimeter-wave and infrared target/background signatures. This data will be provided to current development efforts, such as WASP, for exploitation (2) A flight weight/size Tactical Global Positioning System receiver will be developed as an option for low cost midcourse guidance; (3) The Low Cost Inertial Guidance Subsystem development will be completed. Proof of performance by flight tests under the midcourse guidance demonstration program will be accomplished. In addition, the development of the Digital Integrating Subsystem structured to accommodate the Low Cost Inertial Guidance Subsystem as an inertial reference system will be completed; (4) The Joint Navy/Air Force Millimeter Synthetic Aperture Radar technologies will be initiated for missile guidance application in standoff missiles which will have the ability to acquire and track high value targets such as ships, airfields and bridges. This launch-and-leave capability offers significant reduction in attrition and improved effectiveness; and (5) The development of an advanced anti-radiation missile seeker will be initiated for use against early warning/ground control intercept radars, jammers, and air-to-air targets.

(U) Air-to-Air Technology: (1) The Active Laser Seeker development will be completed and flight tested to demonstrate improved acquisition range, terminal accuracy, and countermeasure rejection. If successful, this concept will be a candidate for the next generation of short range air-to-air missiles guidance; and (2) A Focal Plane Array Infrared sensor will be developed for adverse weather capability, air-to-air and air-to-surface application.

(U) Aircraft Gun Technology: (1) 30MM linear linkless gun feed system feasibility development will be completed. The design allows more massive cartridges and demonstrates weight, volume and packing density improvements over current systems. A 30MM armor piercing incendiary projectile will be initiated to provide an improved kinetic energy projectile for the GAU-8 to counter Soviet armor improvements; (2) The development of the telescoped ammunition concept which seeks significant improvement in the kill capability of aerial cannons by using higher muzzle velocities, and greater packaging efficiency will be completed; and (3) A stabilization gun development will be initiated to demonstrate the feasibility of moving the gun in relation to the aircraft to provide an increased probability of hit in air-to-air and air-to-surface applications.

3. (U) FY 1982 Planned Program: The FY 1982 program predicated on adequate funding will emphasize the development of technology to support the development of weapons for adverse weather/night and increase the survivability of the delivery aircraft through the use of standoff and indirect attack weapons. The major efforts within each project are as follows:

(U) Ordnance Technology: (1) The Low Altitude Dispenser which will provide standoff and off-axis delivery capability while providing optimum patterns for the submunitions employed will continue development and will be free flight tested;

Program Element: #63601F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology

Budget Activity: Advanced Technology Development, #2

(2) The Anti-Material Incendiary Submunition development will be completed. This submunition will provide a significant increase in capability for defeating diesel fueled lightly armored targets; and (3) The Standard Stores Interface (MIL-STD-1760) will be validated by the Air Force and Navy.

(U) Air-to-Surface Guided Weapons Technology: (1) A Synthetic Aperture Radar seeker will be developed and tested. This Joint Air Force/Navy development will provide an urgently needed guidance option for attacking targets such as buried command, control and communication facilities; (2) Millimeter-wave seeker will be developed and tested jointly by the Air Force and Navy. This concept will demonstrate the ability of autonomous (lock-on-after-launch) guidance for defeating mobile targets; and (3) Low cost mid-course guidance concept such as a Tactical Global Positioning System and Inertial Guidance Subsystem will be demonstrated through flight testing.

(U) Air-to-Air Technology: The Focal Plane Array Infrared Seeker will complete development and will be captively flight tested in FY 1983.

(U) Aircraft Gun Technology: (1) Development of a stabilized gun will continue for use on next generation aircraft; telescoped ammunition development will continue.

4. (U) FY 1983 Planned Program: The FY 1983 program will continue the development of technology to support air-to-surface weapons for use in adverse weather and night as defined by European and Middle East non-nuclear scenarios. Development of a bunkered target defeat munition for defeat of hardened buried command, control, and communications facilities will be continued. The cued dispenser technology development will be continued. An advanced unitary munition development will be continued to demonstrate a more lethal warhead with potential for guided missile or bomb application. Brassboard captive flight testing of an emitter homing seeker will continue to demonstrate a capability against certain high value radar targets. Seeker fabrication of the Midcourse Guidance Demonstration Phase III will be completed in preparation for a demonstration test of an integrated seeker/flight vehicle system. A captive flight demonstration of an air-to-air active laser seeker will begin after completion of laboratory testing of a prototype seeker and fabrication/integration of test units. A multi-mode air-to-air radar seeker will be developed for laboratory testing. Development of a self-defense gun for tactical aircraft will be initiated. Development of new ammunition concepts for telescoped cartridges will continue. A program will be initiated to interface the linear linkless feed systems technology to telescoped ammunition development.

5. (U) Program to Completion: This is a continuing technology base program.

6. (U) Milestones: Not Applicable

Project: 670B

Program Element: #63601F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Air-to-Surface Guided Weapons Technology

Title: Conventional Weapons Technology

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is a continuing effort to provide the technology base necessary to support future development of improved air-to-surface guided weapons. The objectives are to develop and demonstrate technologies to improve the Air Force's air-to-surface guided weapons capability. Emphasis is on technologies which provide for affordable, standoff, adverse weather guided weapons. This project is divided into two tasks: Midcourse Guidance Technology and Air-to-Surface Terminal Guidance Technology. Midcourse Guidance Technology - The primary objective of this task is to provide a significant improvement in cost for tactical weapon avionics. There are basically two thrust areas within this task: (1) Low Cost Inertial Guidance Development; (2) Core Avionics. Air-to-Surface Terminal Guidance Technology - The primary objective of this task is to develop and demonstrate terminal guidance seekers which can achieve hit-to-kill accuracies against armored vehicles and high value fixed targets. Autonomous (lock-on-after-launch) and non-autonomous (lock-on-before-launch) modes of operation for the guidance seekers shall be considered. Autonomous techniques for acquiring and tracking Radio Frequency emitting threats, especially enemy communications facilities and jammers, are stressed. Efforts under this task are structured to investigate technical alternatives which lower risk associated with ongoing system development programs and develop a firm technical base required to support proposed system development programs.

(U) RELATED ACTIVITIES: This project demonstrates tactical air-to-surface guided weapons advanced technology initially investigated in Air Force exploratory development Conventional Munitions (PE 62602F) or Aerospace Avionics (PE 62204) programs. Coordination is maintained with Air Force advanced development programs: Advanced Avionics for Aircraft (PE 63202F), NAVSTAR/GPS (PE 64778F), and with the Ordnance Technology Project 670A and Air-to-Air Technology Project 670E of this program element. Outputs from this project are primarily into Advanced Attack Weapons (PE 63609F); past "graduates" have also transitioned into the Close Air Support Weapons System (PE 64608F) and Surface Defense Suppression (PE 64733F) programs. Tri-Service coordination is accomplished through the Joint Technical Coordinating Group for Munitions Development, the Joint Service Guidance and Control Committee established by DOD Instruction 5154.26 and other joint specialized committees formed in specific technology sub-areas. Task areas/work units which are funded/sponsored jointly between the Air Force Armament Laboratory and Air Force Avionics Laboratory include: Millimeter Wave Guidance supporting technology, Global Positioning System Midcourse Guidance, and Low Cost Inertial Midcourse Guidance. Joint-Service funded/sponsored efforts include digital guided weapons technology, millimeter wave guidance technology and Synthetic Aperture Radar seeker technology. International cooperation and coordination is effected under auspices of the Technical Cooperation Program and several specific country-to-country data exchange agreements.

(U) WORK PERFORMED BY: The Air Force Armament Laboratory, Eglin AFB, FL, is the responsible technical activity for this project. Laboratory facilities of the Air Force Armament Laboratory and the Air Force Avionics Laboratory are involved in the work. Test facilities at the Armament Division, Eglin AFB, FL; the Arnold Engineering Development Center, Arnold Air Force Station, TN; and the Central Inertial Guidance Test facility, Holloman AFB, NM, support this project. Major contractors on work units included in this project are: Honeywell, Inc, Hopkins, MI; Hughes Aircraft

Corporation, Canoga Park and Culver City, CA; Texas Instruments, Dallas, TX; Teledyne Systems Co, Northridge, CA; Lear Seigler, Grand Rapids, MI; Computer Science Corporation, Huntsville, AL; Martin Marietta, Orlando, FL; McDonnell

Project: 670B

Program Element: #63601F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Air-to-Surface Guided Weapon Technology

Title: Conventional Weapons Technology

Budget Activity: Advanced Technology Development, #2

Douglas, Huntington Beach, CA; General Dynamics, Pomona, CA; and Sperry, Orlando, FL. Five other contractors hold additional contracts, for a total of 21 contracts in this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: During FY 1980 the following was accomplished. (a) Millimeter Wave Contrast Guidance Seeker for autonomous lock-on-after-launch terminal guidance against armor was successfully demonstrated. A technological breakthrough was achieved by demonstrating the feasibility of Millimeter Wave Seekers in the completely autonomous mode. Seekers were captive flight tested over a wide variety of targets and clutter backgrounds; (b) The feasibility of using the Global Positioning System (GPS) as a technique for updating tactical missile inertial systems was demonstrated. A simplified GPS receiver/processor was flown on an F-4, simulating tactical subsonic missile dynamics in a jamming environment. Results were extremely successful in both position accuracies (three dimensions) and Electronic Countermeasures testing; (c) The preliminary design of the Midcourse Guidance Demonstration flight test vehicle and integrated guidance system was completed; and (d) The first practical subwavelength passive interferometer capable of sorting and accurately selecting a single emitter from a field of like emitters broadcasting co-frequency Continuous Wave waveforms was demonstrated. This capability exposes a whole new class of targets, represented by Command, Control and Communications and jammers, to lethal countermeasures.

2. (U) FY 1981 Program: The FY 1981 program will emphasize guidance technology for Air-to-Surface guided weapons and demonstrate the feasibility of this technology. Captive and free flight testing of midcourse guidance technology will begin in late FY 1981 and continue through FY 1984. The midcourse guidance subsystems technologies (hardware and software) to be developed and demonstrated under the Midcourse Guidance Demonstration program are the Industry Low Cost Inertial Guidance Subsystem, The Digital Integrating Subsystem, the Unaided Tactical Guidance software and the Tactical Global Positioning System Receiver. Free-flight testing of other midcourse guidance subsystems, such as strapdown laser gyro inertial guidance subsystems, will be accomplished to provide further validation of these systems for cruise missile applications. Development of terminal guidance technology for air-to-surface weapons will continue in FY 1981. The efforts under this task consists of Millimeter Wave Seeker Technology, Synthetic Aperture Radar Seeker, Emitter Homing Technology Seeker, Infrared Guidance Technology and Advanced Air-to-Surface Seeker Technology.

3. (U) FY 1982 Planned Program: The FY 1982 program will consist of the following efforts. A flight weight tactical Global Positioning System receiver will be designed, fabricated, and tested in preparation for flight testing. The Low Cost Inertial Guidance Subsystem will complete development with acceptance tests and limited environmental testing to determine inertial sensor interchangeability and proof of performance. Development of the Digital Integrating Subsystem structured to accommodate the Low Cost Inertial Guidance Subsystem as a midcourse update capability will be completed. An unaided tactical guidance capability which will provide a low cost jamproof guidance for standoff tactical missiles will be validated. The Joint Navy/Air Force Millimeter Wave and Synthetic Aperture Radar technologies will be developed for missile guidance application in standoff missiles which will have the ability to acquire and

Project: 670B

Program Element: #63601F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Conventional Weapons Technology

Budget Activity: Advanced Technology Development, #2

track high value targets such as ships, airfields and bridges. Development and demonstration of infrared terminal guidance for air-to-surface weapons will continue with captive flight tests. Possible applications are an advanced WASP, a harassment drone and/or an advanced guided bomb. The Midcourse Guidance Demonstration will continue with the procurement of test vehicle and hardware-in-the-loop simulation to verify test conditions. Development of a preliminary design of an advanced anti-radiation missile seeker based on emitter homing technology will continue for use against early warning/ground control intercept radars.

4. (U) FY 1983 Planned Program: The FY 1983 program will include continuing work on the Joint AF/Navy Synthetic Aperture Radar Seeker Demonstration Program, Emitter Homing Seeker development and Midcourse Guidance Demonstration. Evaluation of Tactical Global Positioning System Guidance Class M Receiver will be conducted under dynamic conditions. The Advanced Digital Integrating System code generator and advanced inertial sensor evaluation will begin in FY 1983.

5. (U) Program to Completion: This is a continuing technology base project.

6. (U) Milestones: Not Applicable

7. (U) Resources: (\$ in thousands):

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RD76E	13,206	12,297	13,400	11,900	Continuing	Not Applicable

(U) 8. Comparison with FY 1981 Descriptive Summary:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RD76E	13,150	12,700	13,200		Continuing	Not Applicable

FY 1982 RDT&F DESCRIPTIVE SUMMARY

Program Element: #63605F

DOD Mission Area: Directed Energy Technology (ATD),
#554

Title: Advanced Radiation Technology
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
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TOTAL FOR PROGRAM ELEMENT 79,800* 58,481 82,729 101,746 Continuing Not Applicable

* Reflects correction of administrative error in 30 Sep 80 data base: +\$1,500 thousand.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the Air Force program for demonstrating the technical and engineering feasibility of using high energy lasers as directed energy weapons in USAF weapons systems. In general, the program includes broad based technology development in all aspects of laser weaponry plus airborne demonstrations of laser weapon technology. In particular, the

capability addressed by the Air Force Mission Element Need Statement for Space Defense.

RASIS FOR FY 1982 RDT&E REQUEST: Compared to the FY 1981 program, the FY 1982 program involves major increases in the support of high energy laser technology development applications. For high energy laser systems, the Mid Range Applied Technology program involves significant investments in the start of the laser system design and in the development of advanced beam control/adaptive optics technology demonstration program, the cylindrical The FY 1982 program also involves the Airborne Laser Laboratory chemical laser integration/test program, and the expansion of the technology base for airborne laser weapons. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk, and inflation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	89,800	78,300	97,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Project: #317J

Program Element: #63605P

DOD Mission Area: Directed Energy Technology, #554

Title: Advanced Radiation Technology

Title: Advanced Radiation Technology

Budget Activity: Advanced Technology Development, #2

DETAILED BACKGROUND AND DESCRIPTION: The Air Force projects a continuing requirement to defend aerospace systems against attack. The demonstration of the gas dynamic laser concept in 1966 and the subsequent development of flowing gas laser systems provided the first laser devices with sufficient energy to be effective as directed energy weapons. Extensive studies indicated that a high energy laser can be effective against targets such as air-to-air and surface-to-air missiles, ballistic missiles, aircraft, and spacecraft. Some characteristics which make this effectiveness possible are (1) speed of light delivery with minimum lead correction and virtually no opportunity for evasive maneuver by the target; (2) rapid engagement of multiple high speed targets; (3) wide field of fire; (4) energy delivery to specific target areas with little collateral damage; (5) large magazine; and (6) reusability which permits hands-on training. Successful operational laser weapon systems will have a major impact on the overall offensive and defensive strategies of US military forces. This is a broad-based technology program to demonstrate the technical and engineering feasibility of using high energy lasers as directed energy weapons in Air Force tactical and strategic combat environments. The first demonstration of laser weapon (in an airborne environment will be accomplished by the Airborne Laser Laboratory. The Airborne Laser Laboratory includes a gas dynamic laser at 10.6 micrometers wavelength installed aboard a modified NKC-135 aircraft. The Airborne Laser Laboratory will demonstrate effectiveness at short range against aircraft or missile targets. Prompted by the increasing maturity of this technology, the High Energy Laser Technology Applications Study, completed in July 1978, has evaluated near-term technology and a range of potential laser weapon applications. Specific high-payoff missions identified by this analysis include

The Airborne Laser Technology program addresses the feasibility of near-term high energy laser technology for aircraft defense applications. This includes evaluation of repetitively-pulsed laser system concepts which offer enhanced propagation and target interaction capabilities. At intermediate ranges (up to 100 km), laser systems operating at shorter wavelengths become more advantageous and greater pointing and tracking precision is required. The cylindrical deuterium fluoride chemical laser at about 4 micrometers wavelength shows promise of achieving efficient operation at the higher powers (up to 100 MW) required for intermediate range missions, and the subsystems technology for more precise pointing and tracking systems is being pursued to meet the requirements for intermediate range beam control systems. The development of the Airborne Laser Laboratory-II will be based on this technology to demonstrate the feasibility and lethality of airborne laser weapons in intermediate range aircraft defense missions.

The technology required for long range applications is being pursued on a conceptual basis, including laser devices with even shorter wavelengths and associated beam control systems. In particular, this includes increasing emphasis on the technology for applications from space platforms. Finally, in order to define and evaluate Air Force applications, a program in system and application studies, propagation, and effects and vulnerability of targets is being pursued.

Project: #317J

Program Element: #63605F

DOD Mission Area: Directed Energy Technology, #554

Title: Advanced Radiation Technology

Title: Advanced Radiation Technology

Budget Activity: Advanced Technology Development, #2

(U) RELATED ACTIVITIES: This program element (PE) is part of a Department of Defense program which is coordinated by the Under Secretary of Defense for Research and Engineering, and which includes work in: Defense Advanced Research Projects Agency PE 62301E, Strategic Technology, and PE 62711E, Experimental Evaluation of Major Innovative Technology; Army PE 62307A, Laser Weapon Technology; Navy PE 62735N, High Energy Laser Technology, and PE 62768N, Directed Energy Technology; and Air Force PE 62601F, Project 3326, Laser Applications. Coordination occurs through annual apportionment reviews and quarterly High Energy Laser Review Group meetings attended by the Army, Navy, Air Force, and DARPA laser program managers. Coordination with Department of Energy is effected by attendance at the Department of Energy laboratory technical program reviews, exchange of technical reports, and cooperative efforts at the working level.

(U) WORK PERFORMED BY: The Air Force Weapons Laboratory, Kirtland Air Force Base NM is responsible for managing this program. The ten major contractors in FY 1980 were: Rockwell Rocketdyne, Canoga Park CA; Hughes Aircraft, Culver City CA; University of Dayton Research Institute, Dayton OH; General Dynamics, Fort Worth TX; Perkin-Elmer, Danbury CT; Dynallectron, Albuquerque NM; McDonnell Douglas, Huntington Beach CA; R&D Associates, Marina Del Ray CA; Westinghouse, Baltimore MD; Ford Aerospace, Newport Beach CA. The contracts totaled \$46.7 million; in addition to the above, there were 30 additional contractors with contracts totaling \$12.6 million. In-house test facilities involved in this work include the Advanced Radiation Technology Facility at Kirtland Air Force Base NM.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The research and development of high energy laser technology can be broadly characterized as the development of the technology base, the demonstration of the feasibility of using laser systems as weapons, and the study of potential applications for laser weapons. In laser device technology, high power operation has been demonstrated in the carbon dioxide gas dynamic laser, the repetitively-pulsed carbon dioxide electric discharge laser, the carbon monoxide electric discharge laser, and the hydrogen fluoride/deuterium fluoride chemical laser; the oxygen-iodine chemical laser has been identified for scaling to high power; and other concepts for short wavelength laser devices have been investigated. In beam control technology, highly accurate beam control systems have been developed and demonstrated at low power aboard the Airborne Laser Laboratory in realistic airborne environments; the feasibility of pointing and tracking systems has been demonstrated in laboratory experiments and in ground-based field tests against targets; first-generation adaptive optics correction systems have been developed and successfully tested; and work has begun on advanced adaptive concepts to significantly improve overall laser system performance on target. Fire control technology has been investigated and a radar fire control system was developed and successfully ground tested.

The demonstration of weapons feasibility began in 1973 with the destruction of an airborne drone with a carbon dioxide gas dynamic laser integrated with a pointing and tracking system on the ground. The airborne demonstration of feasibility is an objective of the Airborne Laser Laboratory program; the Airborne Laser Laboratory high energy laser system has been integrated and successfully tested on the ground, and installation into the Airborne Laser Laboratory aircraft, an MKC-135, has begun in preparation for flight testing. The Mid Range Applied Technology program has been established to demonstrate

high energy laser system. System studies and application analyses have been undertaken to provide direction to the technology base development and demonstration and to establish potential laser weapon effectiveness.

Project: #317J

Program Element: #63605P

DOD Mission Area: Directed Energy Technology, #554

Title: Advanced Radiation Technology

Title: Advanced Radiation Technology

Budget Activity: Advanced Technology Development, #2

2. FY 1981 Program: In the Airborne Laser Laboratory program:

In the Airborne Laser Technology program:

repetitively-pulsed laser systems for aircraft defense applications;

the deuterium fluoride cylindrical chemical laser and

the evaluation of

the fabrication of the associated annular resonator optics and alignment system; define critical issues and develop the conceptual definition of shorter wavelength laser systems for both short and intermediate range (up to kilometers) aircraft defense. In the Mid Range Applied Technology program:

In Advanced Development/

Support activities: Continue the development and expansion of the technology for high energy lasers, including the investigation of concepts for short wavelength laser systems; and complete system studies and application analyses to identify critical technology for space-based lasers.

3. FY 1982 Planned Program: In the Airborne Laser Laboratory program:

Airborne Laser Technology program:

In the

gain generator the annular resonator and alignment system with the

oxygen-iodine chemical laser device for airborne applications and begin the design of a

continue investigations of critical beam control technology; continue technology

development and effects/vulnerability investigations to evaluate repetitively-pulsed laser systems for aircraft defense

applications. In the Mid Range Applied Technology program:

In Advanced

Development/Support activities: Continue the development and expansion of the technology for high energy lasers, including the investigation and development of concepts for short wavelength laser systems.

Project: #317J

Program Element: #63605F

DOD Mission Area: Directed Energy Technology, #554

Title: Advanced Radiation Technology

Title: Advanced Radiation Technology

Budget Activity: Advanced Technology Development, #2

4. FY 1983 Planned Program: In the Airborne Laser Laboratory program:

In the Airborne Laser Technology program:

evaluation of pulsed and continuous wave laser system technologies for short range aircraft defense applications; continue laser device and beam control technology investigations for intermediate range applications. In the Mid Range Applied Technology program:

In Advanced Development/Support activities: Continue the development and expansion of the technology for high energy lasers, including component development/scale-up of short wavelength laser system concepts.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	79,800	58,481	82,729	101,746	Continuing	Not Applicable
8. <u>Comparison with FY 1981 Budget Data:</u>						
RDT&E	89,800	78,300	97,900		Continuing	Not Applicable

The current FY 1982 resource estimate reflects a decrease of \$15.2 million from the previous estimate. The Airborne Laser Technology program has been established through a consolidation of activities previously described as the Short Range Technology and Intermediate Range Technology programs. The integrated system development and effectiveness/lethality demonstrations previously planned for repetitively-pulsed laser systems under the Short Range Technology program have been re-directed because of the termination of Army High Energy Laser program participation in the system development and out-year budget pressures. The revised program for repetitively-pulsed lasers involves technology development, extensive effects/vulnerability testing, and effectiveness analysis.

described Airborne Laser Laboratory-II program has been eliminated as a current-year effort; the technical activities

The previously

2nd 3012

Project: #317J

Program Element: #63605P

DOD Mission Area: Directed Energy Technology, #554

Title: Advanced Radiation Technology

Title: Advanced Radiation Technology

Budget Activity: Advanced Technology Development, #2

have been assigned to the Airborne Laser Technology program until the choices of laser system technology and platform are made. In the Mid Range Applied Technology program,

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63723P

Title: Civil and Environmental Engineering Technology
DOD Mission Area: Engineering Technology (ATD), #553
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		2700	3860	4100	4700	Continuing	Not Applicable
2103	Environmental Quality/Facilities						
	Energy Technology	300	790	800	800		
2104	Civil Engineering Technology	2400	2870	3000	3500		
2672	Special Terrestrial Power		200	300	400		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Supports Air Force civil and bioenvironmental engineers; provides technology base to ensure air base survivability and enhance force readiness. Includes efforts to: develop an improved Post Attack Launch and Recovery capability; optimize airfield surfaces maintenance, repair, and new construction techniques; provide technology for more effective tactical deployment, air mobility, and base survivability; ensure compatibility with Federal, Department of Defense, and local environmental policies and regulations during peace time; and adapt Department of Energy technology to reduce Air Force energy consumption and petroleum-fuel dependence.

(U) BASIS FOR FY 1982 RDT&E REQUEST: In support of the Tactical Air Forces' need for Post Attack Launch and Recovery, surface roughness criteria for the F-111, equipment for use with advanced materials for bomb-damage repair, and a soft surface aircraft response computer code will be developed. In support of the Air Force need for Recycling Air Force Pavements, asphaltic binders will be evaluated to optimize additives needed to recycle the harder pavements used in Air Force runways. In pollution control technology, land recovery efforts from Herbicide Orange and development of remote sensing for Titan II/hydrazine operations will begin. Demonstration of the survivability of renewable energy systems for the MX Missile System will be started. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk, and inflation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	2700	3900	4600		Continuing	Not Applicable
Military Construction			None			

(U) OTHER APPROPRIATION FUNDS: (\$ in Thousands)

Military Construction

3700

276 311 311

Program Element: #63723F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Civil and Environmental Engineering Technology
Budget Activity: Advanced Technology Development #2

(U) DETAILED BACKGROUND AND DESCRIPTION: There are numerous problems affecting the Air Force in the areas of civil engineering, environmental engineering and energy. One of the most important is the launch and recovery of aircraft after an enemy attack. The Tactical Air Forces Statement of Operational Need 319-79, Post Attack Launch and Recovery, states that to support the Tactical Air Forces' mission to conduct sustained combat operations, the Air Force requires an improved capability to launch and recover aircraft from its own and allied air bases following a conventional air attack. Although the Tactical Air Force is primarily concerned with its main operating bases because they support the primary in-place forces, a similar capability is required for those bases which will be supporting the augmenting forces and resupply airlift. Efforts in this program element address the technology for rapid assessment and repair of bomb damage, the identification of alternate surfaces to support launch and recovery, and the establishment of roughness criteria for aircraft operations over repaired or alternate surfaces. A second problem is stated in Air Force Engineering and Services Center Statement of Operational Need 01-80, Recycling Air Force Pavements: The Air Force Civil Engineer is responsible for maintaining over 250 million square yards of airfield pavement throughout the world. This represents over \$9.5 billion in capital replacement costs, over 10% of the total Air Force facilities. Increasing construction cost and continued deterioration of those pavements are limiting the quality of runways, taxiways, and aprons the Air Force has to support strategic defense and offense, airlift and counter-air mission areas. If current methods are used to maintain and repair pavements in the future, they will continue to deteriorate because of Operations and Maintenance dollar constraints. Only by developing and employing recycling technology can the Air Force maintain serviceable airfield pavements under current funding policies. Efforts within this program element are aggressively attacking this problem. Other problem areas supported in this program element include environmental pollution and energy conservation.

(U) RELATED ACTIVITIES: The efforts within this program are of significant interest to the other services and are specifically coordinated through the Joint Services Civil Engineering Research and Development Coordinating Group, which is responsive to the Department of Defense. This group ensures efforts are not duplicated across the services and that maximum technology transfer is obtained. Efforts of civilian or national interest are coordinated as appropriate with Federal Aviation Agency, National Aeronautics and Space Administration, Environmental Protection Agency, and Department of Energy; and joint programs have been established with those agencies. Other agency research programs in energy and environment are periodically assessed by the Air Force to take advantage of those technologies at little or no cost. This program directly funds related engineering development projects in Program Element 64708F, Other Operational Equipment. Additionally, Program Element 62601F, Advanced Weapons, directly funds exploratory development in Environmental Quality and Civil Engineering technology.

(U) WORK PERFORMED BY: This program is managed by the Director of Science and Technology, Air Force Systems Command and is executed by the Engineering and Services Laboratory, Air Force Engineering and Services Center, Tyndall Air Force Base, FL. Ten percent of this program's work effort is accomplished in-house while the remainder is accomplished under contract. In-house laboratory facilities include the capability for: subscale and limited full scale protective construction and pavement weapons effects testing; design and test of airfield pavement materials and construction techniques; computer facility and utility design analysis; and environmental chemistry research. In 1980, the top contractors were: BDM Corporation, McLean VA; University of California, Irvine, CA; University of Texas, Austin, TX; University of California, Riverside CA; University of Tennessee, Knoxville, TN; Science Applications, Incorporated, La Jolla, CA; and Southwest Research Institute, San Antonio, TX.

Program Element: #63723F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Civil and Environmental Engineering Technology
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1980 and Prior Accomplishments: A three-year research effort to describe the environmental chemistry of hydrazine fuels in support of Space Division and the F-16 Systems Program Office was completed. Development of accidental impact descriptors that define safe operating requirements for air-to-ground ranges was completed to support the Air Force Range Planning Program. In energy conservation, hangar and high bay conservation methods were identified which have a potential savings of 2,000 barrels of fuel oil per hangar annually. In support of the Tactical Air Forces Statement of Operational Need 319-79, Post Attack Launch and Recovery, a technique for repairing small craters with crushed limestone was developed, an interim repair procedure for spalls using a polymer-concrete was developed, and procedures for field use were published for both.
2. (U) FY 1981 Planned Program: Continue support of Tactical Air Force's Statement of Operational Need 319-79, Post Attack Launch and Recovery. Specific efforts: In bomb damage repair, complete methyl methacrylate polymer concrete evaluation for repair of small craters and spalls; continue advanced materials application. In surface roughness, complete development of the C-130 and C-141 roughness criteria. Continue damage resistant runway materials analysis and testing; continue the alternate launch and recovery surfaces concept study and start test program to validate selected concepts. Complete development and transition damage assessment system to Aeronautical Systems Division; complete manual damage assessment system. In support of Air Force Engineering and Services Center Statement of Operational Need 01-80, write program management plan for recycling pavement materials to provide high load bearing asphaltic pavements; continue developing criteria for Air Force recycled asphaltic pavements. Continue foam wall system for emergency facilities and emergency repair of battle damaged facilities. Complete design of advanced panel for air mobile shelters. In pollution control technology, complete criteria for water reuse on bases in water poor areas; continue methods for treatment of specific toxic wastes. In environmental assessment technology, start advanced toxic corridor calculations and model. In facilities energy, complete identifying potential energy resources at Air Force installations. In special terrestrial power, start adapting Department of Energy fuel cell technology to Air Force applications.
3. (U) FY 1982 Planned Program: Support of Post Attack Launch and Recovery will continue. Specific efforts include: Start development of surface roughness criteria for the F-111; continue development of Surface Roughness Criteria for F-15, F-16, and A-10; complete development of surface roughness criteria for F-4, C-130 and C-141; begin development of equipment validation of the soft surface aircraft response code; complete the Alternate Launch and Recovery Surfaces concept study; and complete the Post Attack Requirements Study. In support of the Statement of Operational Need for recycling airfield pavements, specific efforts on the fractional composition of asphaltic binders will be evaluated to optimize the additives needed to recycle the harder asphaltic pavements used in Air Force runways. In pollution control technology, efforts will begin on the recovery from Herbicide Orange (based on previous work in Program Element 62601F), as well as development of remote sensing devices in support of Titan II/hydrazine operations.

Program Element: #63723F

DOD Mission Area: Engineering Technology (ATD), #553

Title: Civil and Environmental Engineering Technology
Budget Activity: Advanced Technology Development #2

Efforts will continue in the management of mixed metal sludges. In environmental assessment technology, work will continue in toxic corridor calculation methods, and the development of the emissions inventory system for ground support equipment will be completed. In facilities power systems, a new effort to study the survivability of MX Missile System renewable energy systems will begin. Work will continue on development of multi-fueled fuel cell, and heat engines.

4. (U) FY 1983 Planned Program: The planned program will continue to emphasize technology development of advanced materials, techniques, and procedures which will enhance the Post Attack Launch and Recovery capability and decrease airfield vulnerability in the North Atlantic Treaty Organization wartime environment. Work will continue to develop computer simulated runway roughness criteria and data for several tactical aircraft (A-10, F-111). Design, test, and evaluation of bomb damage repair techniques and alternate launch/recovery surfaces will continue. Work will continue in identifying post attack environments, required for development of a post attack action plan. Work will continue in airfield pavements materials recycling. In environmental areas, work will continue in mixed metal sludge management, toxic corridor calculation methods, and development of the emissions inventory system. The Renewable Energy System survivability study will continue. Work will continue on the development of a multi-fueled fuel cell for base application, and on multi-fueled heat engines. Limited real growth in FY 1983 funds is directed primarily to efforts in the Post Attack Launch and Recovery program.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63728F

Title: Advanced Computer Technology

DOD Mission Area: Electronic and Physical Sciences
(ATD), #551

Budget Activity: Advanced Technology Development #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Program to Completion
	TOTAL FOR PROGRAM ELEMENT	4,200	4,650	4,900	5,900	Continuing	Not Applicable
2527	Life Cycle Management	100	0	0	600	Continuing	Not Applicable
2528	Software Data Collection and Analysis	464	560	600	0	0	2035
2529	Computer Architecture Applications	200	600	800	600	Continuing	Not Applicable
2530	Distributed System Reliability and Survivability	156	1,100	2,200	3,100	Continuing	Not Applicable
2531	Software Engineering Tools and Methods	1,320	940	300	0	0	3270
2532	High Order Computer Language Discipline	1,960	1,450	1,000	1,600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program will develop and demonstrate technologies to reduce the mushrooming costs of developing and modifying military computer software. Thrusts are aimed at automating the software development process, introducing a prudent amount of standardization into the process, and providing management tools and methods to control the process. It is also responsive to the fact that weapons system complexity and the availability of low cost microprocessors are driving military embedded computer systems toward the concept of distributed data processing. A major program thrust will exploit advances in distributed processing technology and develop techniques to satisfy critical military requirements such as fault tolerance, reliability, and survivability in the battlefield environment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Major thrust is on developing techniques to decentralize the control of military distributed processing systems in order to eliminate the central control processor as a potential single point failure element. Methods of fault sensing, data sharing and automatic reconfiguration, critical to increased system reliability and survivability in the distributed environment, will be developed and evaluated using products of the distributed system simulation effort. Ongoing efforts in multiple microprocessor design methodology aimed at reducing development and life cycle support costs through effective hardware/software tradeoffs in weapons system acquisitions will continue. Development of compilers and a programming support environment to support implementation of Ada as the new DOD standard computer programming language in FY 1984 will continue. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk and inflation.

Program Element: #63728F

DOD Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>Additional</u>	<u>Program</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>to Completion</u>
RDTE	4200	4100	5400	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable

Program Element: #63728F

DOD Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program was established by the Air Force as a broad based advanced development program in computer resource technology. The Air Force recognized that software development was a labor intensive process and virtually invisible to management. Software development has grown to be one of the most expensive parts of developing a weapon system and has become a pacing factor in delivery schedules. Since all services within DOD have had the same adverse experiences in software development, a DOD-wide program was established as outlined in the Defense Computer Resources Technology Plan. This plan ties the software cost reduction programs of all services together to achieve maximum benefits from invested funds by eliminating duplicative efforts. Program Element 63728F, along with related exploratory and engineering development efforts, implements the Air Force portion of the DOD program and has thrusts in six distinct areas: (1) Life Cycle Management - to develop automated aids to effectively transform user needs into specifications for systems with embedded computer resources, prepare basic designs meeting these specifications and, evaluate the impact of proposed changes in specifications or design on overall system capabilities, complexity, and cost; (2) Software Data Collection and Analysis - to collect and analyze software acquisition and maintenance data as a probe into high cost/high error areas of software to develop mathematical models of the software acquisition and maintenance processes based on the collected data in order to predict software life cycle cost and support requirements; (3) Computer Architecture Applications - to evaluate Air Force computer architecture needs and assess commercially available technology to meet these needs, to develop and demonstrate effective techniques to incorporate and maintain microprocessors in weapon systems; (4) Distributed System Reliability and Survivability to simulate distributed Command, Control, and Communications systems configured for strategic and tactical applications, to develop techniques to design, test, and validate such configurations and to evaluate system performance under stress; (5) Software Engineering Tools and Methods - to demonstrate the technology for making programming aids available to geographically separated users; (6) High Order Computer Language Discipline - to support the DOD High Order Computer Language Commonality Program for implementing Ada, the proposed DOD-wide standard language, includes the development of Ada compilers to be hosted on Air Force computer systems and development of other programming support tools for Ada.

(U) RELATED ACTIVITIES: This program supports and is responsive to the DOD Defense Computer Resources Technology Plan and the DOD High Order Computer Language Commonality Program. It is related to other programs which constitute the DOD Software Science and Technology Program: 62725A, Computer and Information Sciences; 63723A, Command and Control; 62721N, Command and Control Technology; 63526N, Advanced Computer Technology; 64574N Tactical Embedded Computer Program; 62708E, Distributed Information Systems; 62702F, Command, Control and Communications; 62204F, Aerospace Avionics; and 64740F, Computer Resources Management Technology. Air Force thrusts generally transition into this program from 62702F and are coordinated through technical reviews at the staff and engineering levels. Coordination with other services is achieved through the DOD High Order Language Working Group, The Research and Development Technology Panel of the Management Steering Committee for Embedded Computer Resources and annual DOD apportionment reviews.

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Program Element: #63728F

DOD Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: Advanced Computer Technology
Budget Activity: Advanced Technology Development, #2

(U) WORK PERFORMED BY: Rome Air Development Center, Griffiss AFB NY has management responsibility for this program. Contractors include: Massachusetts Computer Associates, Wakefield MA; Gagliardi Systems Group, Salem NH; Stanford Research Institute, Menlo Park CA; Softech, Waltham MA; Illinois Institute of Technology Research Institute, Chicago IL; Pattern Analysis and Recognition, Rome NY; TRW, Redondo Beach CA; and Honeywell Inc., St Paul MN.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Developed a compiler for the Air Force JOVIAL J73 computer language which is hosted on the IBM 360/370 machine. Developed interface units to allow Air Logistics Centers access to the National Software Works. Began design of a distributed operating system simulation capability to support developments for computer survivability. Provided 600,000 dollars direct support to the DOD sponsored effort which evaluated and modified the Ada language and began development of an Ada compiler validator.
2. (U) FY 1981 Program: Complete development of additional programming support and verification tools for Air Force implementation of the J73 language. Complete National Software Works enhancements required to fully exploit a joint demonstration involving Air Force Systems Command and Air Force Logistics Command. Began development of a multiple microprocessor emulation system on which trade offs between hardware and software can be evaluated early in the system design process. Provide direct support to the DOD managed Ada implementation effort.
3. (U) FY 1982 Planned Program: Begin development and evaluation of techniques to improve fault sensing, resource sharing and automatic reconfiguration in tactical distributed data processing systems. Complete National Software Works operating system and interface processor enhancements to facilitate networking of geographically separated programming tools within the laboratory and logistics communities. Transition the Data Analysis Center for Software to the Defense Technical Information Center where it can support DOD-wide software research and acquisition programs. Demonstrate the distributed processing simulation capability on a candidate command control acquisition project. Continue development of Ada compilers, Ada programming support environment and the multiple microprocessor emulation system. Demonstration of the automated software specification capability will be deferred until FY 1983 due to a 6 month slip in the corresponding exploratory development effort.
4. (U) FY 1983 Planned Program: Demonstrate methodology to automate the generation of software design specifications. Complete demonstration of the distributed processing simulation capability. Continue development of resource sharing and reconfiguration techniques for military distributed processing systems. Complete development of the initial Ada compiler and programming support environment. Begin development of follow-on Ada compilers for specific Air Force language implementation requirements.

Program Element: #63728F

DOD Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: Advanced Computer Technology

Budget Activity: Advanced Technology Development, #2

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

719-3206

(319)

3206

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63743F Title: Electro-Optical Warfare
 DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		8,600	11,290	10,500	18,700	Continuing	Not Applicable
431G	Electro-Optical Warfare	6,900	9,590	8,300	13,300	Continuing	Not Applicable
2222	Advanced Electro-Optical Countermeasures	1,700	1,700	2,200	5,400	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced development, risk reduction and feasibility/military worth demonstration of countermeasures against visually, electro-optically or infrared aimed or guided surface-to-air and air-to-air weapons. Current Soviet antiaircraft artillery (AAA) and radar directed surface-to-air missile (SAM) systems use some form of optics as a backup to the radar when the radar is jammed or ineffective. In addition, shoulder fired SAMs and air launched missiles have been developed to home on engine radiation. Both strategic and tactical aircraft that operate over or near hostile territory may be exposed to these weapons.

BASIS FOR FY 1982 RDT&E REQUEST: Efforts in FY 1982 will provide advanced development addressing existing and predicted shortfalls for countering Soviet air defenses. This will be accomplished by demonstrating improved decoy flares for the F-15 and A-10, to counter advanced threats, lethal and non-lethal counters to threat optical guidance systems, warning sensors to warn aircrews against weapons will be initiated. Based upon previous study, countermeasure concepts against potential threats. The joint Air Force/Navy COMPASS HAMMER electro-optical countermeasure pod, which was started in FY 1975, will complete flight testing. The cost estimate is based upon the number of different critical development areas, technological risk associated with these areas and previous experience.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY

RD&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost	Not Applicable
	8,600	11,800	19,700		Continuing		

4. (U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63743F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Electro-Optical Warfare

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The enemy air defense network is made up of electronic and electro-optical devices that locate, monitor, guide, and control the offensive and defensive elements. Denial of enemy use of these elements is directly related to the survivability of our aircrews and the number of weapons delivered to the target. Initially, enemy air defense systems operated only in the communications and radar frequencies (approximately 20 megahertz to 18 gigahertz). However, as weapon systems became more sophisticated, enemy threat systems began to use optical and infrared (IR) types of devices as a backup or as a primary means to enhance his capability. Recognizing this increased emphasis in electro-optics, Program Element 63743F was established in 1972 to develop and demonstrate countermeasures to these enemy systems. Continuing advances by the enemy in his tactics and improved electro-optical equipment requires a strong electro-optical warfare technology program to provide demonstrated alternatives to these advances.

The program consists of two projects. Project 2222 funds development of active countermeasures and warning/location systems against optical tracking devices used to guide anti-aircraft fire and surface-to-air missiles. Project 431G funds development of both active and passive countermeasures against the entire electro-optical threat class. Active countermeasures include IR guided weapons jammers as well as counters to weapons. Passive counters include aircraft camouflage, IR signature suppression, flares to decoy IR missiles and receiver systems to warn aircrews and activate countermeasures to approaching missiles.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with other Air Force electro-optical, electronic warfare, and reconnaissance and target acquisition programs, as well as the advanced development work in similar areas by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group and memorandum of agreement. Maximum utilization of common optical hardware and techniques is stressed; equipment developed under other programs is modified only enough to perform those functions peculiar to the countermeasures problem. New developments are undertaken only when the technology base does not exist to satisfy the specific function required. Exploratory development efforts are phased into this program from Program Element (PE) 62204F, Aerospace Avionics. Completed electro-optical efforts are transitioned into engineering development under PE 64710F, Reconnaissance Equipment; PE 64738F, Protective Systems; and PE 64739F, Tactical Protective Systems. Joint Air Force/Navy efforts include the Advanced Electro-Optical Countermeasure Pod, COMPASS HAMMER; a low cost tail warning receiver development; and aircraft infrared signature reduction. Joint Air Force/Army efforts include measure effects and infrared and visual counter

WORK PERFORMED BY: Testing is performed at the Air Force Armament Division, Eglin AFB, FL and China Lake, CA. The Air Force Avionics Laboratory, Wright-Patterson AFB, OH, manages the program. The major contractors are: Raytheon Corporation, Bedford, MA - analysis and simulation; AVCO Corporation, Wilmington, MA - flare material and dispensers; HYCOR Corporation, Woburn, MA - flares; MB Associates, San Ramon, CA - flare research and testing; Quest Research, Wash, DC - electro-optical countermeasure technique analysis; Perkin-Elmer Corporation, Wilton, CT - optical receivers; Hughes Aircraft Corporation, Culver City, CA - infrared jammers and optical sensors; Honeywell Inc., Lexington, MA - missile warning system; Martin-Marietta Corporation, Orlando, FL - optical countermeasures; Westinghouse Corporation, Baltimore, MD - optical countermeasures and SAI, Albuquerque, NM - optical countermeasures effectiveness evaluation.

Program Element: #63743F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Electro-Optical Warfare

Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Accomplishments include demonstration and transition of an improved performance, lower cost, and higher availability flare decoy to protect against advanced threat missiles. Camouflage paint schemes were developed and are now used on the F-16, A-10 and E-3A. A missile tail warning system was developed and now is in production for the strategic and tactical aircraft (ALQ-153). Improved flares for the B-52 and F-111 are now in production. Both COMPASS HAMMER optical countermeasure pods completed fabrication and began testing. Concepts for countering measure pods completed fabrication and began testing. Concepts for countering analyzed for follow on hardware development.
2. FY 1981 Program: New starts in FY 1981 include an improved flare development for the F-15 and A-10 following the successful demonstration of flares for the F-4 and B-52 warning and weapon delivery concept based on cueing weapons against passive optical tracking threats. Improvements to optical countermeasure systems to increase range effectiveness and threats, an expendable jammer to counter threat weapons and an warning receiver sensor to warn aircrews and dispense expendable decoys. Continued efforts include adding forward coverage to a tail warning system now under testing to warn close air support aircraft crews, flight testing of the COMPASS HAMMER optical countermeasure pod, and threat optical detection and acquisition technology development to reduce cost and improve countermeasure performance. Scheduled for completion are the decoy flare for the F-4 flight test of a intelligence collection system, and flight test of the dual mode (infrared/pulse doppler) tail warning system for close air support aircraft (required because of the very short response time at low altitude).
3. FY 1982 Planned Program: No new starts are planned in FY 1982. Programs to be continued include improved tactical flare decoys to counter advanced infrared missiles even during afterburner conditions; aircraft visual and infrared signature and suppression demonstrations, design of a system to warn aircrews and cue weapons against optical tracking threats, and expendable decoy to counter weapons, development of warning sensor to warn and initiate decoy countermeasures, and risk reduction efforts for electro-optical countermeasures components including sources and against threat countermeasures. Scheduled for completion is flight testing of Air Force/Navy Compass Hammer Pod. Funding was reduced in FY 1982 in order to fund high priority readiness issues. Several efforts were delayed or stretched out including infrared signature reduction, and risk, cost, size, reliability and maintainability improvements for electro-optical countermeasures.

Program Element: #63743F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Electro-Optical Warfare

Budget Activity: Advanced Technology Development, #2

4. FY 1983 Planned Program: The FY 1983 program represents a significant increase in order to accelerate critical countermeasure technologies. These areas include decoy countermeasures to infrared search track sets and flare rejection techniques similar to those in new US missiles, integrated electro-optical, infrared and radio frequency countermeasure concepts, passive and active weapon countermeasures, spherical coverage missile warning for strategic aircraft to warn against threats, spherical threat warning, and efforts to accelerate an operational capability threats.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

Project: 431G

Program Element: #63743F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Title: Electro-Optical Warfare Budget Activity: Advanced Technology Development, #2

DETAILED BACKGROUND AND DESCRIPTION: Project 431G was established to demonstrate advanced development countermeasures to enemy air defense guidance systems which operate in the optical spectrum.

Examples of such systems are IR heat seeking missiles which home in on aircraft jet engines and television cameras which can track airborne targets and provide guidance to enemy anti-aircraft guns or surface-to-air missiles. Improvements in these systems and development of new weapons other parts of the optical spectrum requires continuing development to gain and maintain and advantage over the threat in order to improve the survivability of our tactical and strategic penetrating forces.

(U) Efforts in Project 431G include the following: (1) a supporting analysis and simulation effort that guides the allocation of funding through the evaluation of new concepts and techniques; (2) camouflage to prevent or delay detection of US Air Force aircraft; (3) receiver systems on aircraft to warn crew members and activate countermeasures; (4) decoys and jammers to counter enemy air defense weapons; and (5) optical intelligence collection devices to gain information about enemy weapons.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with other Air Force electro-optical, electronic warfare, and reconnaissance and target acquisition programs, as well as the advanced development work in similar areas by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group and memorandum of agreement. Maximum utilization of common optical hardware and techniques is stressed; equipment developed under other programs is modified only when the technology base does not exist to satisfy the specific function required. New developments are undertaken only when the technology base does not exist to satisfy the specific function required. Exploratory development efforts are phased into this program from Program Element (PE) 62204F, Aerospace Avionics. Completed electro-optical efforts are transitioned into engineering development under PE 64710F, Reconnaissance Equipment PE 64738F, Protective Systems; and PE 64739F, Tactical Protective Systems. Joint Air Force/Navy efforts include the low cost tail warning receiver development and aircraft infrared signature reduction. Joint Air Force/Army efforts include and visual countermeasure effects and infrared.

WORK PERFORMED BY: Testing is performed at the Air Force Armament Division, Eglin AFB, FL and China Lake, CA. The Air Force Avionics Laboratory, Wright-Patterson AFB, OH, manages the program. The major contractors are: Raytheon Corporation, Bedford, MA - analysis and simulation; AVCO Corporation, Wilmington, MA - flare material and dispensers; HYCOR Corporation, Woburn, MA - flares; MB Associates, San Ramon, CA - flare research and testing; Quest Research, Wash, DC - electro-optical countermeasure technique analysis; Perkin-Elmer Corporation, Wilton, CT - optical receivers; Hughes Aircraft Corporation, Culver City, CA - infrared jammers and optical sensors; Honeywell Inc., Lexington, MA - missile warning system; Martin-Marietta Corporation, Orlando, FL - optical countermeasures; West-Inghouse Corporation, Baltimore, MD - optical countermeasures. and SAI, Albuquerque, NM - optical countermeasures effectiveness evaluation.

Project: 431G

Program Element: #63743F

Title: Electro-Optical Warfare

Title: Electro-Optical Warfare

DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Accomplishments include demonstration and transition of an improved performance, lower cost, and higher availability. flare decoy to protect against advanced threat missiles. Camouflage paint schemes were developed and are now used on the F-16, A-10 and E-3A. A missile tail warning system was developed and now is in production for the strategic and tactical aircraft (ALQ-153). Improved flares for the B-52 and F-111 are now in production. Concepts for countering were analyzed for follow on hardware development.
2. FY 1981 Program: New starts in FY 1981 include an improved flare development for the F-15 and A-10 following the successful demonstration of flares for the F-4 and B-52 warning and weapon delivery concept based on cueing weapons against passive optical tracking threats for which there is no current capability, active visual signature suppression to reduce detection range of fighters like the F-15, development of infrared missile jammer an expendable jammer to counter threat weapons and an warning receiver sensor to warn aircrews and dispense expendable decoys. Continued efforts include adding forward coverage to a tail warning system now under testing to warn close air support aircraft crews, and infrared suppression coatings to reduce signature of supersonic aircraft and missiles. Scheduled for completion are the decoy flare for the F-4 flight test of a intelligence collection system, and flight test of the dual mode (infrared/pulse doppler) tail warning system for close air support aircraft (required because of the very short response time at low altitude).
3. FY 1982 Planned Program: No new starts are planned in FY 1982. Programs to be continued include improved tactical flare decoys to counter advanced infrared missiles aircraft visual and infrared signature and suppression demonstrations, design of a system to warn aircrews and cue weapons against threats, and expendable decoy to counter weapons, development of warning sensor to warn and initiate decoy countermeasures, and infrared technology to defeat advanced flare-rejecting missile seekers. Scheduled for flight test completion is the combined tail and forward coverage missile approach warning system for close air support aircraft.

Project: 431G

Program Element: #63743F

Title: Electro-Optical Warfare

Title: Electro-Optical Warfare

DOD Mission Area: Electronic & Physical Sciences (ATD), #551 Budget Activity: Advanced Technology Development, #2

4. FY 1983 Planned Program: The FY 1983 program represents a significant increase in order to accelerate critical countermeasure technologies. These areas include decoy countermeasures to infrared search track sets and flare rejection techniques similar to those in new US missiles, integrated electro-optical, infrared and radio frequency countermeasure concepts, passive and active weapon countermeasures, spherical coverage missile warning for strategic aircraft to warn against threats, threat warning.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to completion	Total Estimated Costs	Not Applicable
431G	Electro-Optical Warfare	6,900	9,590	8,300	13,300	Continuing		
8. (U) <u>Comparison with FY 1981 Budget Data:</u>								
RDT&E								
Project 431G		6,900	10,100	19,700	Continuing	Not Applicable		

FY 1982: Funding in FY 1982 represents a \$11,400 thousand decrease. This is due to the transfer of \$2,200 thousand and consolidation of efforts in visual electro-optical countermeasure technology development in Project 2222. In addition, overall program element funding was reduced in order to fund higher priority Air Force readiness issues. The impact of this decrease will delay efforts in electro-optical countermeasures, infrared signature reduction, and spherical coverage missile protection.

FY 1982 DESCRIPTIVE SUMMARY

Program Element: #63750F Title: Counter-Countermeasures (CCM) Advanced Development
 DOD Mission Area: Electronic & Physical Sciences (ATD), Budget Activity: Advanced Technology Development, #2
 #551

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,982	6,700	2,000	8,800	-	22,482
2333	Ground Radar Electronic Counter-Countermeasures	800	1,250	1,000	1,900	-	4,950
2334	Airborne Radar Electronic Counter-Countermeasures	2,082	3,000	0	2,800	-	7,882
2335	Communication & Navigation						
2347	Electronic Counter-Countermeasures	1,050	1,250	1,000	2,200	-	5,500
	Optical Counter-Countermeasures	1,050	1,200	0	1,900	-	4,150

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This technology base program element is the only Air Force advanced development program element developing generic counter-countermeasures for ground radar, very high frequency and high frequency communications, airborne radar and electro-optical weapons and sensors. A recent Library of Congress report comparing U.S. and Soviet weapons technology shows the Soviets with a clear lead in both countermeasures and counter-countermeasures development. Individual Air Force programs are responsible for developing counter-countermeasures into their systems, however, this technology base program element is vitally needed to assist these programs in providing generic counter-countermeasures that can be incorporated into both developmental and fielded systems.

BASIS FOR FY 1982 RDT&E REQUEST: Ground radar passive correlation techniques for improved electronic counter-countermeasures will be initiated. Development of a radar main beam noise cancellor will continue. The low cost anti-radiation missile decoy for will complete testing. The countermeasures resistant very low frequency and high frequency communications adaptive antenna will be transferred to engineering development. The troposcatter communications system with a full duplex capability will be transferred to engineering development. Funding for projects 2333 and 2335 was reduced and funding for projects 2334 and 2347 deferred due to competing readiness initiatives and limited total Air Force funds for FY 1982.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	5,200	5,760	6,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63750F

POB Mission Area: Electronic & Physical (ATD), #551

Title: Counter-Countermeasures (CCM) Advanced Development
Budget Activity: Advanced Technology Developments #2

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element (PE) was established to counter an increasing counter-measure (CM) threat as documented by requirements arising from Southeast Asia, the Middle East, and threat projections for Central Europe. Some current US electronic equipments require discrete counter-countermeasures (CCM) modifications to keep pace with the threat and to extend their useful operational life in jamming, deception, chaff, clutter or suppression environments; thereby avoiding more expensive system replacement programs. Future radar, radio, and optical equipments will benefit from early, systematic, and economical incorporation of state-of-the-art CCM capabilities during their design stage. Programmable processing that will allow changes via software will allow future systems to more readily keep pace with the threat. However, a continuing program to develop new software and in some cases, hardware, will be required if the Air Force is to operate effectively in a hostile electromagnetic combat environment.

(U) Program Element #63750F contains four projects: #2333, Ground Radar Electronic Counter-Countermeasures; #2334, Airborne Radar Electronic Counter-Countermeasures; #2335, Communications & Navigation Electronic Counter-Countermeasures; and #2347, Optical Counter-Countermeasures. Tasks scheduled under these projects will cross-apply appropriate, demonstrated technologies to develop wide application of CCM techniques for existing and developmental systems. The following general task areas will be used: simulation and analysis, waveform generation, signal radiation and reception, signal discrimination and enhancement, survivability enhancement technology, electro-optical (E-O), laser, and infrared vulnerability assessments.

(U) RELATED ACTIVITIES: This program will affect strategic offense and defense and general purpose force activities, and responds to a wide range of requirements. Technical coordination will be effected with laboratories and commands of the Navy and Army, as well as in-house Air Force technical agencies and facilities and the operational commands. PE 64201, Aircraft Avionics Equipment Development, is developing advanced software for aircraft radars with programmable signal processors (e.g., F-15). PE 63750F, Project 2334 will feed that effort.

(U) WORKED/PERFORMED BY: Rome Air Development Center, Rome NY has program management responsibility and project responsibility for ground radar and communication/navigation CCM; the Air Force Avionics Laboratory, Wright-Patterson AFB, OH has project responsibility for airborne radar CCM and optical CCM. Specific tasks will be performed by Air Force computer simulation facilities or other agencies possessing necessary expertise or resources. Some tasks will be performed under contract. The low cost decoy effort is on contract to Brunswick Corp., Costa Mesa, CA; the Tropo Communication Antenna and Processor is on contract to CHR Incorporated, Needham, MA. The very low frequency antenna receive system is on contract to AIL division of Eaton Corp.; and the Air-to-Air Radar Baseline Technology contract is with Hughes Aircraft Corp., Los Angeles, CA. Optical CCM contracts are to Mead Technology Laboratories Dayton, OH; Science Applications Corp., La Jolla, CA; Hughes Aircraft, Culver City, CA; Honeywell Corp., Boston, MA; and Systems Research Laboratory, Dayton, OH.

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Program Element: #63750F

POD Mission Area: Electronic & Physical Sciences (ATD),
#551

Title: Counter-Countermeasures (CCM) Advanced Development
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

(U) Project #2333: A signal processor (using spread spectrum technology) for a Digitally Coded Radar was developed in conjunction with Program Element (PE) 63789F, command, control, and communications advanced development. Development of The Ultra Low Sidelobe Antenna and Anti-Radiation Missile Alarm Sensor has been transferred to PE 27412F, Tactical Air Control System Improvements for Engineering Development.

(U) Project #2334: Development began on the air-to-air counter-measures (CM) technology baseline to determine electronic CCM techniques applicable to modern pulse doppler digital radars and to establish quantitative engineering baseline data. Radar test units were instrumented. Enemy electronic countermeasures threat scenarios have been developed.

Project #2335: Design of a Phased Array Receive Antenna and Adaptive Signal Processor for Troposcatter Communication was completed.

high frequency adaptive antenna receiver system for Design of a very low frequency/
Communications Adaptive Antenna and complementary Adaptive Signal Processor was completed. The design of Troposcatter cancellor as near term fix was begun. Fabrication of an Adaptive Antenna Processor for Troposcatter Communications was started.

Project #2347: Tasks were initiated to reduce the vulnerability of imaging electro-optical (E-O) receivers to flares and spoofers; develop a mathematical model of the acquisition/tracking system for laser guided weapons and develop new techniques for modulation and coding, use of
conduct a vulnerability assessment of E-O receivers and illuminators; compare optical target and decoy signatures; reduce to defeat laser countermeasures; and develop second generation coding schemes for laser signal discrimination and rejection of jammers. A wide dynamic range receiver processor development and target discriminating receiver demonstration were initiated.

2. (U) FY 1981 Planned Program:

(U) Project #2333: Continue development of the low cost Anti-Radiation M'ssile Decoy. Continue development of main beam noise cancellation capability.

(U) Project #2334: Complete roofhouse testing of instrumented F-15 radar in electronic countermeasures environment.

Program Element: #63750F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Counter-Countermeasures (CCM) Advanced Development
Budget Activity: Advanced Technology Development, #2

Project #2335: Complete test and evaluation of the troposcatter communication antenna and signal processor and transition to Full Scale Engineering Development (FSED). Complete development of sidelobe cancellor and start field testing. Continue development of very low frequency/high frequency adaptive antenna. Start development of a new Troposcatter Communications System with a full duplex capability.

(U) Project #2347: Complete laser guided weapon counter-countermeasures alternatives development. Continue target discriminating receiver demonstration and development. Initiate imaging receiver susceptibility reduction.

3. (U) FY 1982 Planned Program:

(U) Project #2333: Complete testing of the low cost Anti-Radiation Missile decoy. Continue development of the main beam noise cancellor. Initiate development of passive correlation techniques for improved electronic counter-countermeasures.

(U) Project #2334: Defer tasks until FY 1983.

(U) Project #2335: Complete testing of VLF/HF terminal and antenna, transition to full scale engineering development. Complete Troposcatter Communication System development and transition to FSED. Initiate development of millimeter wave low probability of intercept air communication development.

(U) Project #2347: Defer tasks until FY 1983.

4. (U) FY 1983 Planned Program:

(U) Project #2333: Complete development of the main beam noise cancellor and passive correlation techniques.

(U) Project #2334: Initiate and complete flight testing of instrumented F-15 radar.

(U) Project #2335: Complete design of low probability of intercept communications.

(U) Project #2347: Complete target discriminating receiver development. Complete imaging receiver susceptibility reduction task.

5. (U) Program to completion: Program is scheduled to terminate in FY 1983. Funding for projects 2333 and 2335 was reduced and funding for projects 2334 and 2347 deferred in FY 1982 due to competing readiness initiative and limited total Air Force funds for FY 1982.

6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63751F

DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Innovations in Education and Training
Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1,597*	1,680	2,600	2,900	Continuing	Not Applicable
1959	Advanced Systems for Human Resources Support of Weapon System Development	207	100	200	0		1,600
2359	Pilot Performance Measurement	325	300	400	500	1,100	2,700
2361	Maintenance Training Simulation	650	780	700	500	1,800	5,500
2362	Computer-Based Maintenance Aids	415	300	400	400	1,000	2,515
2557	Integrated Training Management System		200	900	1,200	5,800	8,100
2744	Human Factors Data Bank for System Design and Use				200	9,800	10,000
2745	Computer-Based File of Tech Information on Human Resources				100	11,900	12,000

*Reflects recent reprogramming action of +\$30 thousand.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force must develop innovative ways of lowering training costs while actually improving training and the skill level of Air Force personnel. This program is designed to develop technology and procedures needed to improve the value of flight simulators in pilot training through application of automated measurement of pilot performance; increase technical training productivity through the use of training simulators rather than operational equipment; reduce student school-house time; improve on-the-job training methods and improve the quality of technical school graduates; and increase the productivity of maintenance technicians throughout the development and application of a computer-based technical documentation system; decrease life cycle costs and improve upon our logistics plans by including human factor considerations early in the design of weapon systems.

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Program Element: #63751F

DOD Mission Area: Environmental and Life Sciences (ATD). #552

Title: Innovations in Education and Training
Budget Activity: Advanced Technology Development, #2

(U) BASIS FOR FY 1982 RDT&E REQUEST: A significant effort to determine the cost effectiveness of maintenance training simulation for fighter aircraft, missiles and flight simulators will begin. An aircraft automated aircrew performance measurement system for the C-5 simulator, and the aircraft itself, will be developed and evaluated. A prototype of a computer-based maintenance aid for use by maintenance technicians will be developed which will improve the productivity of our personnel and reduce costs of maintaining a paper technical order system. Development will begin on an on-the-job training system that will use computer technology to help train, test, schedule, and manage our personnel in the on-the-job training. A major share of all training for our forces (70%) is done on-the-job. We must have the capability to train our combat force efficiently - a computer-assisted on-the-job training program will help meet this requirement. The cost estimates were derived using analogous contract manhour, material, and overhead charges adjusted for program complexity, risk and inflation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
		Estimate	Estimate	Estimate	to Completion	Estimated
					Costs	Costs
RDT&E	1,600	1,700	2,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #63751F

DOD Mission Area: Environmental and Life Sciences (ATD), # 552 Title: Innovations in Education and Training Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The current program contains three basic categories of research and development; (1) HUMAN FACTORS (LOGISTICS) - Project 1959 demonstrates techniques for predicting and controlling manpower, personnel and training costs of weapon system ownership as a function of weapon system design characteristics. The techniques, when applied early in the system acquisition process, provide human resource support cost predictions for each design alternative which can be applied in trade-off analysis, and will therefore impact directly on early logistic support considerations. Project 2362 provides a prototype computer-based maintenance aid which includes a portable, interactive computer terminal located at the aircraft that interfaces with a computer-based tech data system. The system will substantially reduce technical data search and retrieval time and improve repair quality and time to completion. (2) EDUCATION AND TRAINING - Project 2557 will develop computer-based systems for administration, management, and delivery of instruction in new technical training applications with emphasis on identification of low cost approaches for the delivery and management of individualized instruction in On-the-Job Training and Field Training Detachments; and (3) TRAINING DEVICES AND SIMULATORS - Project 2359 develops automated performance measurement techniques to optimize effectiveness of flight simulators. A capability for training managers to assess the effectiveness of their flight simulation training program will be developed. Project 2361 demonstrates applications of computer-based simulation technology for training Air Force maintenance personnel. Demonstration of the F-111 avionics test station simulator will continue and alternate devices will be evaluated to provide a comprehensive assessment of simulator fidelity requirements. User handbooks (guides) and model specifications for application in acquisition of new simulators will be developed. A strategic missile maintenance simulator and flight simulator troubleshooting trainer will also be developed.

(U) RELATED ACTIVITIES: Related Air Force program elements are 61102F, Defense Research Sciences; 62205F, Training and Simulation Technology; and 63227F, Advanced Simulator Technology. Navy and Army Program Elements are 62757N, Human Factors and Simulation Technology, 63701N, Human Factors Engineering Development; 63720N, Education and Training; 62722A Manpower, Personnel and Training; 63743A, Education and Training. There is a Memorandum of Agreement with the Military Airlift Command that outlines responsibilities for development of the Pilot Performance Measurement System. The Air Force Human Resources Laboratory is working directly with Air Training Command in the demonstration and evaluation of the simulators for maintenance training. A triservice working group presently is assessing the total Department of Defense effort in technology development of simulation for maintenance training. The Navy Personnel Research and Development Center is conducting a Research and Development effort to support HARDMAN. The Air Force Human Resources Laboratory manager for Project 1959 has coordinated efforts with the Navy's HARDMAN Research and Development manager. The Army Research Institute is planning a related effort. The Air Force Human Resources Laboratory has a Memorandum of Agreement with the Deputy for Avionics Control Board, Aeronautical Systems Division, Wright-Patterson Air Force Base OH, for evaluation of Project 1959. Naval Training and Equipment Center, Orlando FL, is conducting an effort to develop computer-based aids for maintenance training.

(U) WORK PERFORMED BY: The program is managed by the Air Force Human Resources Laboratory, Brooks Air Force Base TX, through the Logistics and Technical Training Division, Wright-Patterson Air Force Base OH; and Operations Training Division, Williams Air Force Base AZ. These divisions are collocated with their primary Air Force customer so as to provide maximum technology transfer. The major contractors in FY 1980 were: Logicon, Incorporated, San Diego CA; Honeywell, Incorporated, Minneapolis MN; Denver Research Institute, Denver CO; Westinghouse, Baltimore MD; Unified Industries, Springfield VA; SAI Comsystems, San Diego CA; Burtel Incorporated, Tulsa OK; and Boeing, Seattle WA.

Program Element: #63751F

DOD Mission Area: Environmental and Life Sciences (ATD), #552

Title: Innovations in Education and Training
Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Advanced Simulator for Pilot Training was modified to simulate air-to-air and air-to-ground combat tactics. Design of an automated aircrew-performance measurement system was completed and fabrication of the system begun. Handbooks to guide the acquisition of maintenance training devices were developed and two prototype maintenance simulators, differing in level of fidelity, were delivered for training effectiveness evaluation. The cost of a maintenance simulation trainer is significantly lower than an actual test station with no loss in the quality of training. Design has been completed for a prototype computer-based maintenance aid for maintenance technicians. A system of models and other techniques for predicting and controlling manpower, personnel, and training costs of weapon system ownership as a function of weapon system design characteristics has been completed.

2. (U) FY 1981 Program: An automated pilot-performance measurement system will be fabricated and installed on a C-5 simulator at Altus Air Force Base, Altus OK. An evaluation will be made of a high fidelity and a low fidelity simulation of the F-111 Flight Control Test Station to determine their effectiveness for maintenance training and life cycle costs compared to the operational equipment. The fabrication of a very low cost, low-fidelity simulator of the F-111 Test Station using computer graphics, i.e., television display, will be initiated. A maintenance simulator to provide generalized troubleshooting training for flight simulator maintenance technicians will be delivered for evaluation. Design specifications will be developed for a Minuteman missile maintenance simulator. A test and evaluation phase will be initiated for the integration and application of the methodology for utilizing human resources data in weapon system design. Maintenance task information and technical order data will be converted into a computerized maintenance data base for use in a prototype computer based maintenance aid system. An in-depth study of the current on-the-job training system will be done and alternative approaches will be defined. Trade-off studies will be performed on these alternatives and a recommended system will be proposed.

3. (U) FY 1982 Planned Program: A training effectiveness evaluation will be performed for the automated pilot-performance measurement system to determine its contribution to the C-5 aircrew training program of the Military Airlift Command. The development of a low-fidelity, low cost computer graphics, i.e., television display, maintenance simulator of the F-111 Flight Control Test Station will be completed. An evaluation of the maintenance troubleshooting simulator for training flight simulator technicians will be performed to determine its training effectiveness. The documentation and training will be completed for transitioning the technology to designers and logistics planners. Work will be completed on the conversion of technical data into a computerized format for use in a prototype computer-based maintenance aid. The system specifications will be developed for the selected approach to managing, delivering, and evaluating on-the-job training.

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Program Element: # 63751F

DOD Mission Area: Environmental and Life Sciences (ATD), # 552 Title: Innovations in Education and Training
Budget Activity: Advanced Technology Development, #2

4. (U) FY 1983 Planned Program: The training effectiveness evaluation of the automated pilot performance measurement system will be completed. A comparative evaluation of high, medium and low fidelity simulation of the F-111 Flight Control Test Station will be performed to determine their training and cost effectiveness. Handbooks will be developed to specify the procedures for designing, building, and utilizing maintenance simulators. Work will be initiated to develop a computer based file of technical information on human resources. Work will also be started on a human factors data bank for systems design and use. A field evaluation will be performed of the prototype computer based maintenance aid system. The construction of a prototype system for managing, delivering, and evaluating on-the-job training will be started.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63789F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Command, Control & Communications Advanced Development

Budget Activity: Advanced Technology Development, #2

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
TOTAL FOR PROGRAM ELEMENT							
2314	Tactical Air Surveillance	2,000	3,100	2,300	8,600		
2315	Automated Tactical Intelligence	3,980	3,600	3,700	5,300		
2317	Tactical Info Proc & Distribution	230	2,768	3,300	4,700		
2321	Advanced Systems Concepts	180	400	100	1,600		
2478	Tactical C-I Architecture	870	1,000	800	2,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This advanced development program provides solutions to selected command, control and communications operational needs and validated operational requirements. This involves the evaluation of technology, conceptual system design, system engineering and fabrication of advanced development models for test and demonstration. In addition, this program provides for the transition from exploratory development to engineering development for those emergent projects that have demonstrated the potential to satisfy Air Force requirements. These requirements include a jam-resistant tactical air surveillance radar with an aircraft identification capability, the handling of intelligence data more efficiently and effectively, a near-real-time ground target location display, new techniques to distribute information, and the development of a tactical command, control, communications and intelligence architecture.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds to continue the advanced development of a jam-resistant tactical air surveillance radar for the Tactical Air Forces, project 2314; demonstration of a near-real-time ground target location display and the automation and integration of multi-source intelligence data for tactical fusion operations including the Combat Operations Intelligence Center in Europe, project 2315; advanced development and demonstration of a high-capacity, processor-controlled communications subsystem to distribute information within tactical command and control centers of the Tactical Air Control System, project 2317; the demonstration of new technology, techniques, procedures and equipments which have the potential to satisfy Air Force requirements, project 2321; and time-phased implementation planning and architecture for future tactical command, control, communications and intelligence systems, project 2478. Budget estimates are based on ongoing contracts and previous costs for similar efforts.

Program Element: #63789F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Command, Control & Communications Advanced Development

Budget Activity: Advanced Technology Development, #2

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
RDt&E						
Procurement	<u>6,400</u> Not Applicable	<u>9,136</u>	<u>17,100</u>	<u>25,400</u>		

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63789F

DOD Mission Area: Electronic & Physical Sciences (ATD), 551

Title: Command, Control & Communications Advanced Development

Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this advanced development program is to demonstrate solutions to tactical command, control and communications operational needs and validated requirements. This objective will be accomplished by the evaluation of technology, conceptual system design, system engineering, demonstration and test of procedures and equipment needed to correct operational deficiencies and satisfy requirements. This program includes five projects. Three of these projects apply new technology in the tactical air surveillance, intelligence and information processing and distribution areas. These projects provide for the development of a tactical air surveillance ground radar including the development of positive aircraft identification techniques; the automation and integration of multi-source intelligence information for the combat operations intelligence centers and tactical fusion operations; and the development of tactical information processing and distribution equipment for the Tactical Air Control System. The Advanced Systems Concepts Project demonstrates the applicability of new technology, techniques, procedures, and equipments which have a high potential for increasing Air Force capabilities. A tactical architectural project provides the time-phased implementation planning required for future tactical command, control, communications and intelligence systems.

(U) RELATED ACTIVITIES: Related Program Elements include: 62702F, Command Control and Communications, for emergent technology; 27412F, Tactical Air Control System, and 27422F, Tactical Air Control System Communications, for engineering development of demonstrated solutions to operational requirements. Applicable technology developed by other sources is utilized to satisfy requirements for future engineering development and acquisition activities. Projects within this program element are coordinated with the Army, Navy and Marine Corps.

(U) WORKED PERFORMED BY: The program is managed by Air Force Systems Command, Andrews Air Force Base, MD, with project effort being conducted by the Electronic Systems Division, Hanscom Air Force Base, MA, and Rome Air Development Center, Griffiss Air Force Base, NY. Current contracts are with the MITRE Corporation, Bedford, MA; RCA, Burlington, MA; TRW, Redondo Beach, CA; RCA, Moorestown, NJ; Sperry Gyroscope Corporation, Great Neck, NY; Pattern Analysis and Recognition Corporation, Rome, NY; Rockwell International, Newport Beach, CA; Bunker Ramo Corporation, Westlake Village, CA; COMARCO Incorporated, Orange, CA; GTE Products Corporation, Mountain View, CA; Synectics Corporation, Rome, NY; Martin Marietta Aerospace, Denver, CO; General Dynamics Corporation, Fort Worth, TX; and Operating Systems, Incorporated, Woodland Hills, CA.

Program Element: #63789F

DOD Mission Area: Electronic & Physical Sciences (ATD), #551

Title: Command, Control & Communications Advanced

Development

Budget Activity: Advanced Technology Development, #2

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A demonstration of high frequency swept spectrum communications to determine the capability for providing survivable communications during trans/post attack was accomplished. Development of an experimental model of a tactical air surveillance radar was initiated in FY 1977 and initial tests were successfully conducted in FY 1980 with a two-dimensional antenna, project 2314. Technology development for a near-real-time positive identification of hostile, friendly and neutral aircraft was initiated in FY 1978, project 2314. Automated integration of tactical intelligence information was initiated in FY 1977, project 2315. Development and demonstration of an experimental penetration analysis support system to assist fighter aircraft mission planning was initiated in FY 1979, project 2315. Development and demonstration of a near-real-time ground target location display was initiated in FY 1979, project 2315. Initial engineering designs for a tactical information processing and distribution system were completed in FY 1979, project 2317. An architectural effort for future tactical command, control, communications and intelligence systems was initiated in FY 1978, project 2478.
2. (U) FY 1981 Program: Development of a jam-resistant tactical air surveillance radar is being continued with initial tests on an experimental model with a two-dimensional antenna and continuation of the three-dimensional antenna development, project 2314. The positive aircraft identification task is being continued with the selection of radar data processing techniques and further definition of identification system concepts, project 2314. Automated integration of tactical multi-source intelligence data to improve reaction time capabilities is being continued, project 2315. Development and demonstration of a computer assisted mission planning system will be completed. Results of this three year effort will form the basis for a follow-on engineering development program to provide an operational fighter aircraft mission planning capability, project 2315. Development of a near-real-time ground target location display is being continued as one of the tasks in project 2315. Development of a high-capacity, processor-controlled communications subsystem to distribute information within tactical command and control centers of the Tactical Air Control System is being continued, project 2317. The demonstration of new technology, procedures, and equipments which have the potential to satisfy Air Force requirements is being continued, project 2321. Tactical command, control, communications and intelligence architecture is being continued, project 2478.
3. (U) FY 1982 Planned Program: The development of a tactical air surveillance radar will continue with functional tests of the experimental three-dimensional antenna elements, project 2314. Based on the tactical air surveillance radar experimental model data and antenna tests, a performance specification for an advanced development model of the radar will be completed, project 2314. The automation and integration of multi-source intelligence data for tactical fusion operations will be continued, project 2315. Development of the capability to provide a near-real-time ground target location display will be continued, project 2315. High-capacity information distribution equipment will be fabricated for test and demonstration, project 2317. The demonstration of high speed communications between Tactical Air Control Party and the Air Support Operations Center for the close air support mission will be completed, project 2321. Time-phased implementation planning and architecture for future tactical command, control, communications and intelligence systems will be continued, project 2478. The FY 1982 planned program was reduced to provide funds for higher priority needs within the Air Force. This reduction in effort primary impacts the tactical air surveillance, automated tactical intelligence and tactical architecture projects.

Program Element: #63789F

Title: Command, Control & Communications Advanced Development

DOD Mission Area: Electronics & Physical Sciences (ATD), #551

Budget Activity: Advanced Technology Development, #2

4. (U) FY 1983 Planned Program: Fabrication of an advanced development model or models of an advanced tactical air surveillance radar will be initiated, project 2314. Efforts to provide accurate and timely classification and identification of aircraft will be continued, project 2314. The automation and integration of multi-source intelligence data for tactical fusion operations will continue, project 2315. The capability to identify, track and display mobile ground targets based on the simulated operation of advanced sensor systems will be demonstrated, project 2315. The design, fabrication and initial test of a high-capacity, processor-controlled communications subsystem for the Tactical Air Control System will be completed, project 2317. The demonstration of new technology, techniques, procedures and equipments which have the potential to satisfy Air Force requirements will be continued, project 2321. The time-phased implementation planning and architecture for tactical command, control, communications and intelligence systems will be continued, project 2478.
5. (U) Program to Completion: This is a continuing program to provide for the transition of selected command, control, and communications technology projects to engineering development.
6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64247F (63247F)

Title: Modular Automatic Test Equipment (MATE)

DoD Mission Area: Electronics and Physical Sciences, #551

Budget Activity: Advanced Technology Development, #2

RESOURCES: (Project Listing) (\$ in thousands)

Program Element	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,300	13,700	20,700	35,800	29,500	110,100
63247F	Modular Automatic Test Equipment 5,300		13,700				
64247F*	Modular Automatic Test Equipment			20,700	35,800	29,500	

*This is a program element number change to reflect the transition from advanced development to engineering development.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Some previous and current methods used to specify, design, build and support automatic test equipment have resulted in a proliferation of equipment, inadequate operational reliability and supportability and excessive lifecycle costs. Aircraft availability (force readiness) has suffered because of malfunctioning automatic test equipment at all levels of maintenance. The Modular Automatic Test Equipment program is developing a family of modular automatic test equipment (hardware and software) which can be configured to test many different weapon systems at all levels of maintenance, and will establish a management framework for the acquisition and support of future Air Force automatic test equipment. The first two weapon systems to use Modular Automatic Test Equipment will be the A-10 Inertial Navigation System (INS) and the Low Altitude Navigation, Targeting, Infra-Red for Night (LANTIRN) pod. The automatic test equipment for these systems is being developed as part of the Modular Automatic Test Equipment engineering development program.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds for development of the A-10 inertial navigation system and LANTIRN pod automatic test equipment, and for development of the replacement system for the Computer Operated Multi-function Electronics Test Set (COMETS), a system for testing electronics cards for the F-4, F-111, and F-15 avionics test equipment which has reached the end of its useful life. The A-10 inertial navigation system and LANTIRN pod automatic test equipment will allow the Air Force to maintain these systems in the field without contractor support. Eliminating the need for field contractor support on these units will allow the Air Force to attain the required readiness posture. Replacement of COMETS is essential to maintain the operational readiness of the F-4, F-111, and F-15 aircraft currently in the field. Cost estimates are based on a 1977 Air Force internal estimate which used computer cost models, F-16 automatic test equipment development costs and contractor historical data. The estimate will be updated in 1981 based on the engineering development contract price.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Estimated Costs
RDT&E	5,300	13,600	28,000		56,500	108,300

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64247F (63247F)

DoD Mission Area: Electronics and Physical Sciences, #551

Title: Modular Automatic Test Equipment (MATE)
Budget Activity: Advanced Technology Development, #2

(U) DETAILED BACKGROUND AND DESCRIPTION: The requirement for automatic test equipment (ATE) to maintain sophisticated electronic systems has been confirmed by government and industry studies conducted over the past several years. It is agreed that automatic test equipment is essential to mission effectiveness -- without properly functioning avionics, combat aircraft do not fly. Although the Air Force spends over \$800 million annually to design, acquire, and support ATE, the equipment is complicated to operate, malfunctions often, and is difficult to maintain. Faults in electronic equipment detected at the flight line or intermediate shop too often cannot be duplicated when the equipment is returned to the depot for repair. Hence, equipment is recycled in the supply lines and not available for use on aircraft. The studies also identified proliferation of test equipment as a reason for the high cost and unreliability of ATE. For example, there are over 100 different computers in the Air Force ATE inventory each with its own unique maintenance and repair manuals and spare parts list. Air Force attempts to solve ATE problems through management initiatives have not been effective. The MATE program was established and funded in FY 1978 to integrate management and technical answers to ATE problems. In June 1978 the Systems Management Division of Sperry Corporation, and the Integrated Logistics Support Division of the Westinghouse Electric Company were awarded fixed price contracts to perform the system definition phase of the MATE program. The survey/study and study/verification segments of these contracts are complete. These contracts will conclude with the demonstration phase in early 1981. Based on the results of these contracts and proposals for the engineering development program, either Sperry or Westinghouse will be selected to develop the automatic test equipment for both the A-10 Inertial Navigation System (INS) and the Low Altitude Navigation and Targeting, Infra-Red for Night (LANTIRN) pod. The winner will also finalize the guide books which were submitted in draft form as part of the system definition contracts. The finished guidebooks will incorporate the lessons learned from previous ATE acquisition programs and the MATE/A-10 engineering development program and will provide the basis for acquisition and support of Air Force automatic test equipment for the foreseeable future. Systems selected for MATE application include: the A-10 Inertial Navigation System; the LANTIRN pod; and the replacement for the Computer Operated Multifunction Electronics Test Set (COMETS) which is used at depot level to test cards for the F-4, F-111, and F-15 avionics test equipment. This set of applications will demonstrate the validity of applying a common Automatic Test Equipment philosophy to a replacement program (COMETS), a low complexity system that was designed before the test equipment was selected (A-10 INS), and a new, highly integrated and a relatively complex system where testability requirements can be taken into account early in the program (LANTIRN). During the development of the MATE system for the A-10 INS, there will be a period of approximately three years during which the Air Force will buy contractor support for the A-10 INS. The MATE schedule is designed to minimize the length of time that contractor support is required. Any slips in the current MATE schedule will delay the date on which the Air Force can support the complete A-10 system without contractor support in the field. Current estimates show that MATE will make it possible to save at least 15 percent (over \$120 million per year) on automatic test equipment life cycle costs.

(U) RELATED ACTIVITIES: The Navy assigned a fulltime representative to the MATE Program Office in early 1979 to make sure MATE stays attuned to their needs. Army and Navy personnel are currently participating in program task definition, source selections and design reviews. MATE is being supported by technology programs in Army, Navy, and Air Force Laboratories. The Navy developed built-in test design guides and the fault isolation/fault detection work being done at the Air Force Rome Air Development Center will provide a basis for decisions concerning the partitioning of test functions between the ATE and built in test equipment. PE64249F will provide funds for the development of the ATE for LANTIRN; PE27131F will provide \$17M for procurement of 24 A-10 INS automatic test equipment stations. Other supporting program elements include: PE 62204F, Aerospace Avionics, Project No. 2003, Avionics System Design Technology, and Project No. 6069, Electronic Device and Circuit Technology; PE 63253F, Advanced System Integration Demon-

Program Element: #64247F (63247F)

DoD Mission Area: Electronics and Physical Sciences, #551

Title: Modular Automatic Test Equipment (MATE)

Budget Activity: Advanced Technology Development, #2

stration (PAVE PILLAR), PE 64219F, Integrated Digital Avionics, PE 64201F, Project No. 2560, JOVIAL Language Control Facility, and Project No. 2297, Software and Computer Standardization. To prevent duplication of efforts, all cognizant Army, Navy and Air Force organizations are continually supplying inputs to MATE program planning and design reviews. Operating command requirements are being made available to various Air Force, Army, and Navy development and laboratory organizations.

(U) WORK PERFORMED BY: This program is being implemented by the Support Equipment Program Office of the Aeronautical Systems Division at Wright-Patterson AFB, OH. Supporting laboratories are the Air Force Avionics Laboratory located at Wright-Patterson AFB, OH and the Rome Air Development Center at Griffiss AFB, NY. The two system definition contractor are the Sperry Corporation, Great Neck, Long Island, NY, and the Westinghouse Electric Company, Hunt Valley, MD.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This program began in FY 1978 under PE 63247F, Modular Automatic Test Equipment. Major Air Force activities during this period were directed at structuring a program that would solve existing automatic test equipment problems, be responsive to future requirements, and stay in tune with previous and current efforts of the Joint Logistics Commanders and the Industry/Joint Services project. The MATE program objectives and plans were established and briefed to interested Army, Navy and Air Force agencies and to numerous industrial groups. The MATE system definition contract statements of work were prepared, a competition involving over 20 major corporations was conducted and two contracts were awarded in June 1978. The MATE system definition contractors have completed the survey/study and study/verification phases.
2. (U) FY 1981 Program: Complete system definition contracts. Compete and award engineering development contracts to build the Automatic Test Equipment for the A-10 Inertial Navigation System (INS) and the Low Altitude Navigation and Targeting, Infra-Red for Night (LANTIRN) pod.
3. (U) FY 1982 Planned Program: Continue development and test of A-10 INS and LANTIRN Test Equipment. Begin development of the depot level automatic test equipment system to replace the Computer Operated Multifunction Electronics Test Set (COMETS). This is a new program element number for the engineering development phase of the MATE program. The funding for this program was previously shown in PE 63247F, Modular Automatic Test Equipment. The FY 1982 funding requirements for PE 64247F as projected in the FY 1981 budget under PE 63247F have been reduced based on updated requirement for development of the A-10 INS and LANTIRN pod automatic test equipment.
4. (U) FY 1983 Planned Program: Complete A-10 INS and LANTIRN pod Automatic Test Equipment development, begin deliveries of A-10 INS Automatic Test Equipment. Continue development of the COMETS replacement system.
5. (U) Program to Completion: Complete deliveries of A-10 INS and LANTIRN Automatic Test Equipment. Complete development and installation of the COMETS replacement system. Establish an organizational framework for the Air Force to continue the evolution and application of the Modular Automatic Test Equipment concept. Total estimated costs have increased slightly due to inflation.
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63311F

DOD Mission Area: Land Based Strike, #111

Title: Advanced Ballistic Reentry Systems (ABRES)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	95,350	103,600	50,000	92,100	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Ballistic Reentry Systems program (soon to be renamed Advanced Strategic Missile Systems -- ASMS) is the only program providing advanced development of future Air Force ballistic missile systems and subsystems; it remains the single Department of Defense program for advanced development and flight test of reentry vehicles, penetration aid systems and reentry technology in support of the three Services. Early development work is required to gain confidence in engineering feasibility of new technology to insure readiness for rapid weapon development. Soviet throwweight advantages, their capability their continuing program to upgrade strategic offensive effectiveness (e.g., increased missile accuracy), their increased pace in projecting Soviet force, all create a requirement for the United States to upgrade missile technology and to develop offsetting advanced weapons. An added potential benefit of this program investment: demonstrations of such advanced systems serve to divert Soviet spending toward costly countermeasures less threatening to the United States than corresponding investments in their offensive systems.

(U) BASIS FOR FY 1982 RDT&E REQUEST: These funds, as currently programmed, support a phase-out of strategic ballistic missile advanced development. In 1982 and throughout the advanced development phase-out, supporting technology will be pursued for ABM defense penetration aids; maneuvering reentry vehicle guidance; advanced fuze systems; definition of basing approaches and delivery systems for endurance and survivability of warheads and communications; limited nuclear weapon option studies; low level missile technology, including highly reliable laser guidance, and; hypervelocity impact testing of non-nuclear munitions. The Advanced Ballistic Reentry Vehicle prototype design will be updated. All contract costs were estimated based on contractor data and Government experience on similar advanced development programs.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	95,300	110,900	128,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #63311F

DOD Mission Area: Land Based Strike, #111

Title: Advanced Ballistic Reentry Systems (ABRES)
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: This program develops technology and conducts early stages of development for advanced strategic ballistic missile systems. The overall project includes studies and development for missile and basing technologies, reentry vehicles, guidance sensors and penetration aids. The program name is being changed from Advanced Ballistic Reentry Systems (ABRES) to Advanced Strategic Missile Systems (ASMS); this reflects the attention that must be given to all elements of missile systems to gain the highest payoff in weapon system survivability, endurance, and effectiveness. Program priorities, scope and funding requirements are determined by the Under Secretary of Defense for Research and Engineering; program recommendations, management, and funds are provided by the Air Force. The program provides priority support for upgrading operational missile systems, and provides technology expertise and support for intelligence assessments and strategic defensive programs. Technology and systems are being developed which will allow the United States to maintain the survivability, endurance and effectiveness of operational forces currently limited in numbers by factors including existing and contemplated Strategic Arms Limitation agreements. The current technology and development efforts are: ballistic reentry vehicles; maneuvering reentry vehicles; arming, fuzing, and guidance subsystems; penetration aids technology; aerodynamic tests of reentry vehicle airframe components; testing via laboratory, underground nuclear, ballistic missile and sounding rocket flight tests.

the Air Force sees the value of maintaining and increasing these efforts as budgets and near term priorities allow.

(U) RELATED ACTIVITIES: The program is closely coordinated with the Army's Systems Technology Program and Ballistic Missile Defense Advanced Technology Center; Navy's Strategic Systems Program Office; Defense Advanced Research Projects Agency; Defense Nuclear Agency; Department of Energy, Military Applications; Government laboratories and testing facilities; and other agencies associated with ballistic missiles, reentry technology, and surviving/enduring basing. Efforts are coordinated with M-X (PE 64312F) for development of advanced reentry vehicles and penetration aids technology and with the Minuteman Program (PE 11213F) for system modifications and demonstration launches. Coordination is achieved through frequent briefings and exchanges at the working level. Army and Navy personnel are assigned to the program office and are a part of the management structure. Effective coordination and avoidance of duplication with the M-X and Minuteman programs is achieved through joint management of the co-located program offices within the Ballistic Missile Office.

(U) WORKED PERFORMED BY: The responsible Air Force agency is the Ballistic Missile Office, Norton Air Force Base, CA. The ASMS Program contracts with over 50 contractors and makes extensive use of Government laboratories. The major contractors are: AVCO Corporation, Wilmington and Everett, MA - flight test vehicles, penetration aids, and supporting technology; Boeing Aerospace Company, Seattle, WA - Minuteman I booster launch services and basing technology; McDonnell Douglas Astronautics Company, Huntington Beach, CA - flight test vehicles and supporting technology; MIT Lincoln

Program Element: #63311F

DOD Mission Area: Land Based Strike, #111

Title: Advanced Ballistic Reentry Systems (ABRES)
Budget Activity: Strategic Programs, #3

Laboratory, Lexington, MA - systems engineering and penetration aids; Fiber Materials, Inc., Biddeford, ME - nosetips; General Electric Company, Philadelphia, PA - reentry vehicles; General Dynamics, Pomona, CA - fuzes; TRW Systems Group, Redondo Beach, CA - systems engineering support and flight test targeting; Kaman Sciences Corp., Colorado Springs, CO - nuclear effects; Calspan Corp., Buffalo, NY - aerodynamics; PDA Engineering, Santa Ana, CA - reentry vehicles; Aerojet General Corp., Azusa, CA - nosetips, test rockets; Singer-Kearfott, Wayne, NJ - guidance; Raytheon Company, Missile Systems Division, Bedford, MA - guidance; Honeywell, Inc., St Petersburg FL - guidance.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The Advanced Ballistic Reentry Systems program produced the technology base from which past reentry systems have been derived and from which future ones will emanate. Accomplishment with major impact on existing and future systems include: development of slender bodies for high performance reentry vehicles; development of the penetration aids technology base for Minuteman II and III penetration aids systems; development of small ballistic reentry vehicle technology for use as Multiple Independently Targetable Reentry Vehicles, as applied to the Navy MK4 reentry vehicle; development and engineering feasibility demonstration of Maneuvering Reentry Vehicles; development of

development and underground demonstration of materials hardened to nuclear effects; techniques for denying reentry vehicle discrimination by defenses; accomplishment of comprehensive engineering analyses of defensive threats; demonstration of the capability of the Minuteman III missile to deliver up to reentry vehicles, and; development of carbon-carbon nosetip concepts now used on M-X candidate reentry vehicles -- the MK12A, and the Advanced Ballistic Reentry Vehicle. To list other technology accomplishments, inertial guidance subsystems development was begun in 1970, leading to the current design for a Dormant Inertial Navigation System which incorporates ring laser gyros and is well adapted to field operations. The Precision Guided Reentry Vehicle system design study, completed in 1976, established maneuvering system and subsystem requirements and led to the Advanced Maneuvering Reentry Vehicle program; two successful flight tests have now been completed, the second including a Dormant Inertial Navigation System experiment. Aircraft feasibility tests of terminal update guidance sensors for maneuvering vehicles and advanced missile guidance were conducted in 1979 and 1980. Candidate and devices for the maneuvering reentry vehicle flight tested on sounding rockets and Minuteman I boosters in 1980, as was the Continuously Dispensed Master. Multiple experiments for heatshields, nosetips, aerodynamics, vehicle radar transmission arming and fuzing, and penetration aids were flight tested via the Technology Development Vehicle and Advanced Nosetip Test Vehicles. A full scale reentry vehicle, specially configured, was successfully flight tested and recovered for analysis. In 1979 and 1980, four reentry vehicle and decoy flight tests were conducted for the Army's Systems Technology Reentry Experiments Program, successfully completing this ballistic missile defense technology flight series.

Program Element: #63311F

DOD Mission Area: Land Based Strike, #111

Title: Advanced Ballistic Reentry Systems (ABRES)
Budget Activity: Strategic Programs, #3

2. (U) FY 1981 Program: Having completed the second flight, conduct the third Advanced Maneuvering Reentry Vehicle flight test (incorporates an experimental Dormant Inertial Navigation System); pursue low level laboratory tests of inertial navigation systems; conducted the fourth Advanced Ballistic Reentry Vehicle flight test; continue advanced development of an accurate reliable countermeasure resistant fuze for M-X class reentry vehicles; conduct reentry analyses and two flight tests--the fourth Technology Development Vehicle and the first Interim Recovery System -- in support of ballistic and maneuvering preprototype designs; conduct two Minuteman I flight tests of preprototype penetration aids for the Navy Trident MK500 Evader maneuvering reentry vehicle; conduct low level technology for M-X penetration aids; begin testing of hypervelocity impact munitions; continue feasibility tests for the Cruise Ballistic Missile; begin low level concept studies and feasibility analyses for advanced missile system concepts; continue engineering analyses of projected Soviet ballistic missile defense capability based on intelligence data.

3. (U) FY 1982 Planned Program: Defense Penetration Systems. To include: technology and concept design of radar penetration aids for M-X or Minuteman; laboratory tests of the Dormant Inertial Navigation System for the Advanced Maneuvering Reentry Vehicle, applicable to the MK500 Evader; analysis of projected Soviet ballistic missile defense radars; Offensive Mission Capability. To include: advanced development and design integration of an accurate reliable countermeasure resistant fuze for the Advanced Ballistic Reentry Vehicle -- this reentry vehicle would feature an insensitive high explosive warhead (for operational safety) and would be applicable to M-X, Trident II or limited nuclear options; design analysis of sensors for maneuvering reentry vehicles; laboratory tests of hypervelocity reentry munitions (potential non-nuclear weapons); Endurance and Survivability. To include: offensive threat analysis; low level studies of survivable or replenishable basing and launch concepts for secure reserve weapons and communications, command, control, and intelligence systems; Missile Systems Technology. To include: the start of development for a reliable high accuracy dormant laser guidance system, applying ring laser gyro technology for highly mobile missiles; subsystem design analysis for small ballistic missiles, incorporating advanced propellant, structures, and electronics technology.

The 1982 Budget Request for Advanced Ballistic Reentry Systems has been reduced from last year's estimate by 78.7 million dollars; from 128.7 to 50.0 million dollars. Resulting major program changes include: elimination of flight testing on Minuteman I -- no Air Force flight tests -- system development to a technology effort, -- (e.g., the -- readiness program);

a preprototype terminal update guidance sensor system, for maneuvering vehicles to provide capability against hardened and non-fixed targets (e.g., mobile missiles); -- test missile economy and reliability programs. Other programs affected are: Maneuvering Technology Vehicle, -- aircraft launched test rocket for fuze testing, Roll-Isolated Inertial Platform, -- surface proximity fuze, Multiple Payload Program, Advanced Recovery System, -- second MK12A Recovery Vehicle flight test.

Program Element: #63311F

DOD Mission Area: Land Based Strike, #111

Title: Advanced Ballistic Reentry Systems (ABRES)
Budget Activity: Strategic Programs, #3

4. (U) FY 1983 Planned Program: Penetration aids technology; Advanced Ballistic Reentry Vehicle design completion; fuze development completion; low level inertial and terminal guidance testing; completion of hypervelocity impact munition testing; survivable and enduring basing and delivery systems studies; ballistic missile technology, and; engineering analysis of threats and vulnerabilities.

5. Program to Completion: Advanced development will be The remaining tasks will include:
two M-X penetration technology flight tests in FY 84; engineering analysis of offensive and defensive threats, limited concept definition efforts, and support of special studies for advanced strategic missile systems requirements.

6. (U) Milestones: Not applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63318P

DOD Mission Area: Airborne Strike, #113

Title Counter SUAWACS Technology
Budget Activity Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost Not Applicable
TOTAL FOR PROGRAM ELEMENT		12,300	15,800	10,600	15,900	Continuing	Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for the examination of an ordered set of lethal and non-lethal alternatives to counter the Soviet Union Airborne Warning and Control System. The Soviet Union Airborne Warning and Control System, in conjunction with look-down, shoot-down interceptors, will pose a serious threat to the air breathing leg of the TRIAD by the mid 1980s.

The Counter Soviet Union Airborne Warning and Control System Technology Program is examining various alternatives including electronic countermeasures, communications jamming, decoys and air launched missiles to counter this threat.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to conduct limited demonstrations of the critical technologies associated with the most promising non-lethal alternatives and those critical technologies necessary to provide the option for developing an air-to-air missile. Specifically, the lethal technologies to be examined include, (1) missile air-to-air guidance, making maximum use of technology already developed for the Advanced Medium Range Air-to-Air Missile; (2) long range passive location of the Soviet Union Airborne Warning and Control System; and (3) various propulsion alternatives. The lethal portion of the program is part of a joint service effort in Long Range Air Warfare. The Air Force will be prepared to meet a Defense System Acquisition Review Council II in the latter part of fiscal year 1982. The program is structured on a not to exceed basis as directed by the Office of the Secretary of Defense.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	25,000	25,700	50,500		TBD	TBD

(U) OTHER APPROPRIATION FUNDS: None

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Program Element: #63318F

DOD Mission Area: Airborne Strike, #113

Title Counter SUAWACS Technology
Budget Activity Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The program objective is to develop an optimum mix of lethal and non-lethal measures to effectively counter the Soviet Union Airborne Warning and Control System and its associated look-down, shoot-down interceptors. The Counter Soviet Union Airborne Warning and Control System Technology, formerly Advanced Strategic Air Launched Missile, Program examines various alternatives to counter the Soviet Union Airborne Warning and Control System to include electronic countermeasures, communications jamming, decoys and an advanced air-to-air missile. Through fiscal year 1979 the program was a project under Program Element 63314F, Strategic Bomber Enhancement. It consisted of two major efforts: Technology Integration Program and Propulsion Technology Validation. The Technology Integration Program was a competitive effort by eight contractors (two airframe) which included wind tunnel tests of scale model missiles, integral rocket-ramjet engine development and testing, and other subsystem component development. The Propulsion Technology Program, conducted between October 1979 and May 1980, demonstrated existing integral rocket-ramjet technology through flight tests. In March 1980 the Office of the Secretary of Defense decided to defer the Advanced Strategic Air Launched Missile Defense System Acquisition Review Council.

The Air Force restructured the program to ensure an ordered set of lethal and non-lethal alternatives are available in the early-to-mid 1980s. In addition, certain elements of the Advanced Strategic Air Launched Missile program not disturbed by the restructuring were allowed to continue, specifically, Propulsion Technology Validation and Long Range Passive Location. The program restructuring was complete in July 1980, and the Mission Element Need Statement was approved by the Office of the Secretary of Defense in September 1980.

(U) RELATED ACTIVITIES: Program Element 11113F, B-52 Squadrons (Air Force); Program Element 63370F, Advanced Medium Range Air-to-Air Missile (Air Force); Program Element 63318F, Army-Navy Surface-to-Air Missile Technology (Army-Navy); Program Element 63536N, Stand Off Jammer Suppression (Navy); Program Element 63308N, Air-to-Air Missile Technology (Navy); are related to the Counter Soviet Union Airborne Warning and Control System Technology effort.

(U) WORK PERFORMED BY: The overall project manager is the Aeronautical Systems Division, Strategic Systems Program Director, Wright-Patterson Air Force Base, OH. Technical assistance is provided by the following Air Force Laboratories: Aerospace Propulsion Laboratory; Avionics Laboratory; Flight Dynamics Laboratory; and Rocket Propulsion Laboratory. Contractors are: Martin Marietta, Orlando, FL, McDonnell-Douglas, Saint Louis, MO and the Boeing Company, Seattle, WA (Technology Integration and System Studies); Marquardt, Van Nuys, CA, United Technology Corporation, Sunnyvale, CA and Thiokol, Huntsville, AL (Propulsion Development); Martin-Marietta, Orlando, FL (Propulsion Technology Validation); Raytheon, Boston, MA and Hughes, Canoga Park, CA (Guidance Studies); Westinghouse, Baltimore, MD, Motorola, Scottsdale, AZ, International Telephone and Telegraph, Nutley, NJ and AIL, Deer Park, NY (Radar Electronic Countermeasures); and Sylvania, Mountain View, CA and Magnavox, Fort Wayne, IN (Communications Jamming).

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Program Element: #63318P

DOD Mission Area: Airborne Strike, #113

Title Counter SUAWACS Technology
Budget Activity Strategic Programs, #3

PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishment: Technology development and integration on the Advanced Strategic Air Launched Missile began in 1974. Under the Advanced Strategic Air Launched Missile Technology Integration Program, competing contractors prepared preliminary designs, conducted wind tunnel tests on scale models, and ran ground tests on competing integral rocket-ramjet engines. Technology Integration Program development efforts also included tests of critical flight control system components, the firing of a heavy weight solid rocket booster, and additional work on radar cross section reduction. Concurrently, a Propulsion Technology Validation Program was started to demonstrate integrated rocket-ramjet technology maturity. Under the Propulsion Technology Validation effort ground testing was completed as well as several preliminary flight separation tests. This effort included full scale rocket and ramjet engine tests, full scale wind tunnel tests, and airframe structural tests. Separation tests were carried out, initially using missile and carrier aircraft scale models, then progressing to an A-7 and dummy missile. Initial flight test vehicle fabrication was also completed under the Propulsion Technology Validation Program. In fiscal year 1980 efforts were devoted to completing the flight demonstration which began in October 1979 and ended in May 1980. The seven flight test program included six successful and one partially successful effort. Specific Technology Integration Program ground tests during fiscal year 1980 included test firing of the flight-weight rocket booster and additional testing of the integral rocket-ramjet engines. Originally a Defense System Acquisition Review Council I was scheduled to meet in April 1980 to approve further Advanced Strategic Air Launched Missile efforts. However, in March 1980 the Defense Systems Acquisition Review Council I was deferred.

seemingly dispelled by intelligence data indicating the Soviet Union Airborne Warning and Control System would be a definite threat to cruise missile carriers and penetrating bombers. In addition, the Air Force restructured the program to ensure lethal and non-lethal options other than the Advanced Strategic Air Launched Missile are available in the early-to-mid 1980s. The program restructuring was complete in July 1980.

This uncertainty was sub-

2. (U) FY 1981 Program: In fiscal year 1981 the program is investigating various lethal and non-lethal alternatives including air launched missiles, electronic countermeasures, communications jamming and decoys and will recommend an optimized mix of techniques for actual development. The principal products of this effort will be detailed technical descriptions, tradeoff and sensitivity data, cost estimates, and performance projections for all of the alternatives examined. Key technical risk areas will be identified and a risk reduction program recommended.

3. (U) FY 1982 Planned Program: Limited demonstrations of the critical technologies associated with the most promising lethal and non-lethal alternatives will be conducted. This discussion of cost differences in fiscal year 1982 from last year's Descriptive Summary is contained in the "Fiscal Year 1980 and Prior Accomplishment" paragraph.

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Program Element: #63318F

DOD Mission Area: Airborne Strike, #113

Title Counter SUAWACS Technology

Budget Activity Strategic Programs, #3

4. (U) FY 1983 Planned Program: Contingent on Defense System Acquisition Review Council II approval, Full Scale Engineering Development will begin on the optimized lethal and non-lethal solutions.
5. (U) Program to Completion: As currently envisioned, the Full Scale Engineering Development Program will develop and test (ground and flight) the selected lethal and non-lethal systems. The initial operational capability is planned for the mid 1980s with the specific date dependent on outyear funding and future Defense System Acquisition Review Council decisions.
6. (U) Milestone:
- | | |
|---|----------------|
| a. Technology Integration Program Contract Award | June 1974 |
| b. Propulsion Technology Validation Contract Award | March 1976 |
| c. Propulsion Technology Validation First Flight | October 1979 |
| d. Defense System Acquisition Review Council I Deferral | March 1980 |
| e. Program Restructuring Complete | July 1980 |
| f. Mission Element Need Statement Approved | September 1980 |
| g. Defense System Acquisition Review Council II | August 1982 |
| h. Initial Operational Capability | Mid 1980s |

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63319F

DOD Mission Area: Airborne Strike, 113

Title: Advanced Cruise Missile Technology
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,000	13,869	30,100	TBD	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Cruise Missile Technology program develops the technology for advanced cruise missiles with improved propulsion systems, reduced observables (radar and infrared), and uprated avionics. This technology development could lead to a follow-on cruise missile operational by the late 1980s or early 1990s. Program pace will be a function of the evolving Soviet defensive threat to the cruise missile launch aircraft, the cruise missile enroute to the target over enemy territory, and in the target area where terminal defenses may be heavy. This program will maintain the momentum of United States cruise missile development efforts.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request would continue developmental activities in two key areas: propulsion systems and airframe design/evaluation. The highest priority efforts will focus on engine development to improve thrust and reduce fuel consumption. Improved engines could be used to power advanced vehicles as well as to significantly improve the performance of the current cruise missile. These engine development efforts are the highest priority tasks, since engine development lead times exceed those of any other element in the program. Airframe activities will include initiation of ground/flight testing of the advanced cruise missile design developed by the Defense Advanced Research Projects Agency. The combination of improved propulsion systems and advanced airframes is intended to improve carrier survivability through longer range missiles (increased carrier standoff distance) and missile survivability through better performance characteristics and reduced observables - both radar and infrared signatures. Cost estimates for program funding were derived from contractor estimates and previous experience from the Air Launched Cruise Missile program.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	10,000	13,900	30,800		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63319P

DOD Mission Area: Airborne Strike, 113

Title: Advanced Cruise Missile Technology
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is based upon studies and analyses completed by the Air Force, advanced development efforts underway at the Joint Cruise Missile Projects Office, and exploratory development programs at the Defense Advanced Research Projects Agency. The Advanced Technology Cruise Missile studies began in August 1977 and were completed in September 1979. This major study effort evaluated the future threat to cruise missiles against a variety of cruise missile mission concepts (subsonic, subsonic with dash, supersonic, and hypersonic), justified the most cost and mission effective concept, and outlined a technology roadmap needed to develop an advanced missile capable of defeating the evolving Soviet defensive threats both in the air (look-down/shoot-down interceptors) and from the ground (advanced surface-to-air missiles). The work at the Joint Cruise Missile Projects Office is for development of an improved cruise missile engine based upon the evolutionary growth of the current cruise missile engine. At the Defense Advanced Research Projects Agency, work has centered on the development and initial testing of advanced airframe designs. This work is now being transferred to the Air Force for ground/flight/survivability testing. With these efforts as a foundation and continuing support, the program will provide for the advanced development of a new cruise missile through successive demonstration, refinement, and upgrade with options to proceed into engineering development as the threat and requirements evolve.

(U) RELATED ACTIVITIES: The Defense Advanced Research Projects Agency efforts in advanced airframe, material, structure, and propulsion systems are performed under the Strategic Technology (62301E) program, while the current and prior development work under the Air Launched Cruise Missile (64361F) program is the vehicle baseline effort.

(U) WORK PERFORMED BY: Responsibility for this program is assigned to the Aeronautical Systems Division of the Air Force Systems Command at Wright-Patterson Air Force Base, OH. Contractors now involved in the program include: The Boeing Company, Seattle, WA; General Dynamics (Convair Division), San Diego, CA; Williams Research Corporation, Walled Lake, MI; General Electric Company, MA; Garrett Corporation, Los Angeles, CA; and Teledyne CAE, Toledo, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: As a new program start in fiscal year 1980, the initial funding was used to initiate contractual efforts in the areas of engine development and airframe evaluation and design. In the engine area, the Joint Cruise Missile Project Office began work to develop an updated cruise missile engine as an evolutionary upgrade to the current engine. Development objectives are to increase thrust by a minimum of 28% and reduce fuel consumption by a minimum of 5% over the current F-107 engine. The Strategic Systems Program Office began a separate, competitive contractual effort to evaluate an alternative engine with a development objective of a 50% increase in thrust and 15% reduction in fuel consumption over the current cruise missile engine. These parallel efforts are aimed at securing the greatest possible capability improvement in the current engine at low schedule and cost risk, as well as provide an alternative engine approach with higher risk and payoff for advanced missile airframes. Contractual efforts also began to perform an engineering and requirements analysis of a longer range cruise missile based upon the current missile with configurations as long as 315 inches under evaluation. The Defense Advanced Research Projects Agency continued their contractual efforts on advanced, low observable airframes in preparation for transfer of their work to the Air Force.

Program Element: #63319F

DOD Mission Area: Airborne Strike, 113

Title: Advanced Cruise Missile Technology
Budget Activity: Strategic Programs, #3

2. (U) FY 1981 Program: Contractual efforts for development of an improved F-107 engine and a new engine will continue. The system engineering evaluation of a longer range current cruise missile will continue with the intent of either proceeding into advanced development work or continuing systems engineering studies. The impacts involved in longer cruise missile configurations must be carefully assessed in view of reduced missile carriage, greater drag, and higher observables against the payoff in greater carrier survivability because of the potential for increased standoff range. The work underway in the Defense Advanced Projects Research Agency on advanced, low observable airframes will continue and gradually transition to the Air Force as the development moves into the ground/flight demonstration phase.

3. (U) FY 1982 Planned Program: Engine development will continue as the highest priority task in the program. With both engine efforts, the initial design, fabrication, and development of engine components will be underway. Core and rig testing are planned for component development. By the end of the fiscal year, sea level static and limited simulated flight tests will be underway using full scale engines. In airframe development, ground testing of advanced airframe subsystems will begin and planning for flight evaluation of a full scale airframe initiated.

4. (U) FY 1983 Planned Program: Work will continue on engine and airframe development. By this time, program pace and scope will be a function of the Air Force decision to proceed - or not proceed - on an advanced or growth cruise missile with a specific initial operational capability. The development decision will be the result of a critical, and continuing, assessment of the Soviet defensive threat to cruise missiles and their launch platforms.

5. (U) Program to Completion: Develop a new cruise missile to replace or supplement the current cruise missile. The missile will feature an improved propulsion system, reduced observables, and uprated avionics with development pace geared to the evolving Soviet threat.

6. (U) Milestones:

A. Advanced Technology Cruise Missile Studies

B. Program Initiation

C. Engine Development Begins

D. Advanced Airframe Work Transfer to Air Force

E. Narrow Engine Competition

Date

August 1979 - September 1979

April 1980

(May 1980) September 1980

October 1981

(November 1980) July 1981

Program Element: #63319F

DOD Mission Area: Airborne Strike, 113

Title: Advanced Cruise Missile Technology
Budget Activity: Strategic Programs, #3

(U) Explanation of Milestone Changes: Engine development efforts were restructured to incorporate development of an uprated version of the current F-107 cruise missile engine under the management of the Joint Cruise Missile Project Office. In addition, because of the intense engine competition, a longer preliminary design phase will be needed before the competition can be narrowed.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63424F Title: Missile Surveillance Technology
 DoD Mission Area: Strategic Surveillance and Warning, # 132 Budget Activity: Strategic Programs, #3

(U)Resources (Project Listing): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
			12,100	14,200	10,200	Continuing	Not Applicable
TOTAL FOR PROGRAM ELEMENT		3,960					

(U)BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is directed to the collection and analysis of infrared phenomenology associated with the earth (as a background), the surrounding atmosphere, and specific targets such as strategic and tactical missiles and aircraft. Data from this program will directly support design considerations for a follow-on strategic missile warning and attack assessment system that will support National Command Authorities response option selection during a nuclear missile attack.

(U)BASIS FOR FY 1982 RDT&E REQUEST: The FY 1981 program will contribute infrared phenomenology data to support system design and technology development considerations associated with a proposed improvement in performance of the existing space based missile warning system. Data will be collected with high altitude balloon flights, aircraft, and laboratory experiments. These projects will be coordinated with other government agencies (i.e. Defense Advanced Research Projects Agency (DARPA), Army) to assure maximum utilization of resources in support of infrared data requirements. As a result of the Advanced Warning System Defense Systems Acquisition Review Council I Secretary of Defense Decision Memorandum, funding in this line may be used to validate infrared technologies developed in the joint USAF/DARPA technology development program.

(U)COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,960	12,200	14,200		Continuing	N/A

No change since FY 1981 Descriptive Summary.

(U)OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 63424F

DoD Mission Area: Strategic Surveillance and Warning, # 132

Title: Missile Surveillance Technology

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Projected threat level increases in the Soviet Intercontinental Ballistic Missile (ICBM) and Sea Launched Ballistic Missile (SLBM) technology will potentially stress the capability of current surveillance systems which provide tactical warning and very limited attack assessment. New ICBM and SLBM deployment and could reduce the effectiveness of our existing missile surveillance systems. The requirement to provide missile attack characterization beyond an inference that the U.S. missile, bomber, and command and control resources may be threatened demands that the space sensor have the sensitivity to detect the foreign missiles when launched and

The impact footprint will be predicted to

This will provide the National Command Authorities the data necessary to select appropriate response options and the opportunity to conduct effective strategic force management and enhance the United States deterrent posture. Additionally, the need for improved force effectiveness dictates a survivable system capable of providing data during trans and post attack phases of a nuclear war.

The efforts funded under this program element will support design and development of an improved capability missile warning system which will

The spectra of primary interest are Short Wavelength Infrared and Medium Wavelength Infrared from 2 to 7 microns. The technical objective is to support development of a follow-on surveillance system with greatly improved and survivable warning and attack assessment.

RELATED ACTIVITIES:

P.E. 63211F, Project 2100, Laser Hardened Materials, provides information relative to system survivability. A joint Air Force/DARPA Memorandum of Agreement is currently in effect for laboratory infrared measurements and another agreement is pending for technology development.

is the current space-based missile early warning system.

(U)WORK PERFORMED BY: Hq Space Division (SD), Los Angeles, CA, is responsible for the management of this P.E. The Air Force Geophysics Laboratory manages the MultiSpectral Measurements Program (MSMP) and Balloon Altitude Mosaic Measurement (BAMM) tasks for Hq SD. Government agencies supporting the Multi-Spectral Measurements Program include White Sands Missile Range, NM, and Air Force Materials Laboratory, Wright-Patterson AFB, OH. MSMP contractors include White Marletta Corporation, Denver, CO, (ultraviolet sensors), Honeywell Radiation Center, Lexington, MA, (spectral radiometers), and Aerodyne Inc., Burlington, MA, (computer data analysis). Visidyne Inc., Burlington, MA, provides balloon payload and field services support to the Balloon Altitude Mosaic Measurements task.

Program Element: # 63424F

DOD Mission Area: Strategic Surveillance and Warning, # 132

Title: Missile Surveillance Technology
Budget Activity: Strategic Programs, # 3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Development of the optics and focal planes for two sensor configurations were completed. Advanced sensor system concepts for improved surveillance capabilities were studied. Sensor system concept studies were concluded. Aircraft, probe and satellite measurements were performed under Project 2123. Potential sensor and reporting network configurations were defined for a nuclear detonation reporting system using current and future sensors and communications. Contract work demonstrating the capability to fabricate hardened high performance optical devices for use in missile detection systems was completed. Technology efforts were continued in the use of mercury cadmium telluride detectors, charge coupled devices and design of mosaic staring sensor arrays for increased infrared sensor capability. A Mission Analysis for Missile and Nuclear Detonations Surveillance was performed in FY 1975. The Mission Analysis revealed that engineering modifications to the ' would provide an improved interim capability until a well focused technology program could provide the survivability and performance required of a missile surveillance system by the mid 1980's. Goals and requirements for a follow-on were then identified. Under Project 2122 efforts for the development of a mosaic staring sensor and advanced technology for the use of charge coupled devices in missile detection systems were pursued. In Project 2123, spectral background and scintillation collection efforts, applicable to missile surveillance, were initiated using balloons and rocket probes. Aircraft were completed in FY 1978 with Army funding. Mosaic staring sensor validation efforts initiated in FY79 led to two unique approaches in staring sensor design and fabrication. These efforts continued during FY 1979, with \$1.9 million RDT&E funding approved by Congress at a reprogramming hearing in March 1979. Infrared measurements of earth background scintillation continued, using balloons. Measurements of background and engine plumes in space were to be collected using ARIES rockets for launch vehicles. Following a series of delays, a very successful launch was accomplished in May 1980, with data collected from a 300 pound thrust target engine. A Defense Systems Acquisition Review Council I for the Advanced Warning System was held in December 1979 and a technology development program plan was subsequently prepared which, after Congressional approval, will support a technology risk reduction program involving Air Force and Defense Advanced Research Projects Agency mosaic technologies starting in FY 1981.

2. (U) FY 1981 Program: Earth background scintillation measurements and data analysis will continue in support of mosaic sensor design concepts. Infrared and ultraviolet measurements will also continue in addition to planning and preparation for high performance target engine measurements, using excess Minuteman (Upper Stage) boosters for launch vehicles beginning in FY 1983. A third Target Engine Measurement (TEM-3) rocket probe launch is planned for late in FY 1981, employing a 1000 pound thrust target engine. The joint Air Force/DARPA laboratory infrared measurements project will be continued during this year.

(365)

Program Element: # 63424F

DoD Mission Area. Strategic Surveillance and Warning, # 132

Title: Missile Surveillance Technology

Budget Activity: Strategic Programs, # 3

3.(U)FY 1982 Planned Program: Balloon background, rocket probe, and laboratory measurements will be continued to support system design considerations. Technology validation projects will be initiated, with the high altitude balloon being used as a platform to demonstrate mosaic array performance, including background suppression.

4.(U)FY 1983 Planned Program: Primary emphasis during this year will be launch of the High Probe Target Engine Measurement flights to measure target engine infrared signatures at operating altitudes comparable to those achieved during a nominal strategic missile trajectory (200-400 kilometers).

5.(U)Program to Completion: Infrared data collection and technology validation will continue, to provide data that could be used to support system design reviews for eventual development of an infrared mosaic sensor system as a follow-on to the existing missile warning system. The infrared data collection project will be terminated in Fiscal Year 1985 if no further data is required.

6.(U)Milestones: Not Applicable.

(365)

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63425P

Title: Advanced Warning System

DoD Mission Area: Strategic Surveillance and Warning, #132

Budget Activity: Strategic Programs, #3

(U)Resources (Project Listing): (\$ in thousands)

Project Number	Title	FY 1980		FY 1981		FY 1982		FY 1983		Additional to Completion	Total Estimated Costs	Not Applicable
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate					
TOTAL FOR PROGRAM ELEMENT		0	1/	0	0	12,600	11,500			Continuing		

1/ Reflects recent reprogramming action: -\$5,000 thousand.

(U)BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is development of infrared technologies (i.e., mosaic sensor arrays, large capacity data processors, lightweight optics, tunable spectral filters, and passive/active thermal coolers), relevant to the strategic missile warning and attack assessment mission, to achieve confidence for a decision to proceed with development of a follow-on to the existing missile warning system by the mid 1980's. The capability to support additional missions such as technical intelligence, tactical theater operations, and air vehicle detection and tracking will be investigated with this program.

(U)BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 RDT&E program will continue the joint Air Force/Defense Advanced Research Projects Agency infrared technology development program which was initiated in FY 1981. This will include development of broad band infrared mosaic sensors (2-10 microns), compact data processors with large data capacity, a spectrally tunable filter, and further evaluation of metal and glass lightweight optical components. Emphasis will be given to manufacturing methods for mosaic array fabrication. Program cost estimates were prepared by the Air Force and DARPA, based on costs associated with previous technology programs.

(U)COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: This is the initial Descriptive Summary for the Advanced Warning System.

(U)OTHER APPROPRIATION FUNDS: Not Applicable.

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Program Element: #63425F

DoD Mission Area: Strategic Surveillance and Warning, #132

Title: Advanced Warning System

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: In 1974 the Air Force initiated the Missile Surveillance Technology program to develop the technology necessary for future missile warning requirements. This was based on the anticipated need for a significant improvement in the missile surveillance and attack assessment capability by the mid 1980's. Advances in micro-processing and charge coupled device technologies resulted in selection of the mosaic staring infrared sensor as the leading candidate to replace the existing missile surveillance system, the ⁽¹⁾. The principal advantage of the mosaic was the opportunity for on-board processing of the sensor data to reduce the data down-link and ground processing load. In addition, there was the possibility for significant improvement in sensitivity, which would be essential for the attack assessment role. The Mosaic Sensor Program was established as a project within the Missile Surveillance Technology program with the goal of developing and demonstrating the specific technologies required for a follow-on system. It was structured to achieve the goal of a launch to demonstrate the technologies by mid 1984. The demonstration of the technologies plus on-orbit test results were to be the basis for a decision to proceed with prototype sensor development in FY 1985. During review of the FY 1980 defense budget Congress cancelled the Mosaic Sensor Program, based on the absence of a firmly established DoD requirement, and established a new program, the Advanced Warning System. Congressional support for the new program would be obtained pending a Defense Systems Acquisition Review Council (DSARC) review of the requirement to improve the ⁽²⁾ system, identification of which new technologies should be pursued to achieve that objective, and DoD presentation of cost and schedule estimates to Congress. The DSARC decision was to develop a more survivable ⁽³⁾ system and continue development of relevant technologies via a joint Air Force/DARPA technology development program to provide a solid basis for reconsidering the start of engineering development for a follow-on system in a few years. A joint Air Force/DARPA program plan was prepared and was approved by the Air Force in September 1980, with DARPA approval pending. Currently there are no Air Force funds approved for FY 1981, however, DARPA has initiated technology development contracts in support of the joint program in FY 1981.

RELATED ACTIVITIES: Development of infrared technologies was previously pursued under Missile Surveillance Technology, PE 63424F. The ⁽⁴⁾ is the existing space-based missile early warning system. Infrared background and target measurements are conducted in PE 63424F, Missile Surveillance Technology.

(U)WORK PERFORMED BY: Air Force Systems Command is responsible for overall management of this program element. DARPA provides technical guidance through the joint program plan. Space Division, Los Angeles, CA, and Rome Air Development Center, Griffiss AFB, NY, are responsible for management of technology development projects associated with the joint development program.

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Program Element: #63425F

DoD Mission Area: Strategic Surveillance and Warning, #132

Title: Advanced Warning System

Budget Activity: Strategic Programs, #3

(U)PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U)FY 1980 and Prior Accomplishments: Development of mosaic infrared technologies had been in progress since 1976 in PG 63424F. The Air Force complied with Congressional direction to terminate the Mosaic Sensor Program in FY 1980. Based on DSARC direction, a joint Air Force/DARPA technology development program plan was prepared and briefed to the Office of the Under Secretary of Defense, Research, and Engineering in May 1980. Verbal concurrence was received pending submission of the plan for formal approval. The plan was approved by the Air Force in September 1980 and forwarded to DARPA for review and approval.
2. (U)FY 1981 Program: Subsequent to formal OSD approval of the joint technology plan, the Air Force will prepare and present to Congress an overview of the plan. DARPA will continue to fund contracts for development of some of the infrared technologies, based on availability of funding. This includes lightweight optical components, infrared materials for mosaic sensor arrays, and a tunable spectral filter.
3. (U)FY 1982 Planned Program: Funding for technology development by DARPA and the Air Force is programmed in this year. Development of the technologies outlined in the joint program plan will be continued.
4. (U)FY 1983 Planned Program: Testing of several of the developing technologies will be emphasized during this year to prepare for a planned DSARC review of the requirement and the potential for proceeding with development of a follow-on to the existing space-based missile warning system. The program will be structured to continue further technology development if a decision to proceed with engineering development is not achieved.
5. (U)Program to Completion: If a decision is reached to continue technology development, the program will be structured to include development of system design concepts based on expected technology achievements. Planning will be initiated to conduct another DSARC review in FY 1985, with a proposal to proceed with engineering development of the follow-on system.
6. (U)Milestones: Not Applicable.

(36-1/370B)

326 369-320B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

(E) RESOURCES (PROJECT LISTING) (\$ in thousands)^{1/}

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		41,520	39,200	29,300	47,100	Continuing	Not applicable
2698	System Development	34,000	33,400	27,900	39,800	Continuing	Not applicable
2699	Information & Network Development	7,520	5,800	1,400	7,300	Continuing	Not applicable

^{1/} The funding contained within this Descriptive Summary is correct. However, it is at variance with the R-1 document due to late administrative action.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Soviets have an aggressive antisatellite and space program. SPACETRACK has very limited detection capability above 3000 nautical miles (nm).

This program pursues near-term (early 1980's) and far-term (late 1980's) SPACETRACK improvements. Near-term improvements include technology to support a ground-based electro-optics system for high altitude search, a satellite attack warning software system, new capabilities for satellite mission assessment, and existing sensor upgrades. The efforts leading to a far-term capability are to convert SPACETRACK to a near real-time, totally responsive space-based system for satellite attack warning and with reduced dependence on overseas based sensors and with These efforts are specifically oriented toward the development of a space-based long wavelength infrared space object detection and tracking system. This program supports the Presidential and Secretary of Defense Directives for a

BASIS FOR FY 1982 RDT&E REQUEST: Near-term efforts continue the integration and improvement of assets for the tactical assessment of satellite missions, improved orbital processing network analysis, and continued upgrade to the initial operational capability for Satellite Attack Warning and Verification. The efforts supporting the far-term space-based systems are the continued collection of Long Wavelength Infrared (LWIR) background data from probes, the development of long life cryogenic coolers for Long Wavelength Infrared (LWIR) sensor operation, and the development of a Space Infrared Experiment (SIRE) for launch on a shuttle sortie mission. The SIRE and LWIR probe measurements are essential for the as well as the surveillance system. Cost estimates based on prior experience and contractual levels.

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Program Element: # 634287

DoD Mission Element: Space Defense, # 123

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>				
	<u>Actual</u>				
RD&E	42,100				

	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
	44,300	57,400	-	Continuing	Costs
					Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not applicable

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Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

DETAILED BACKGROUND AND DESCRIPTION: The Soviets continue an aggressive antisatellite program. The SPACETRACK system provides limited warning of an attack. It also has a very limited detection capability above 3000 nautical miles (nm) and

The identification of new Soviet space launches cannot support

Because of limited ground sensors, it can take

The Soviet dependence on space is increasing. The ability of these systems to target U.S. forces in near real-time is of paramount importance. Space allows them to operate globally with support systems which are currently free of threat from foreign land, sea, and air forces. These systems provide a force multiplier that is unacceptable with the current force balance. The SPACETRACK limitations cited above have created a situation where

This program is structured into near and far-term improvements. The near-term improvements are specifically oriented to satisfy critical deficiencies using off-the-shelf technology to modernize current capabilities. The remaining program provides for a far-term major upgrade. Initially, existing operational and research and development (R&D) sites were evaluated and consolidated with marginal R&D sites discarded. R&D was performed to increase the operational effectiveness of these sites and transition them to SPACETRACK. New ground-based surveillance systems are being developed where required and space-based systems are being examined to increase the SPACETRACK detection altitude to 22,000nm and beyond and provide

A mathematical model has been developed for the SPACETRACK network to determine the most cost effective R&D and system deployment for correcting current and projected deficiencies.

A major near-term effort has been the development of a Satellite Attack Warning and Verification system. An initial capability was completed in FY 1979 with follow-on improvements in progress. Since Soviet attack against a U.S. space

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

system could indicate the initiation of a strategic or theater Soviet attack, it is essential that advance notification be provided to the National Command Authorities as soon as possible so that the attack can be assessed and forces can be alerted.

The program for the far-term option includes developments leading to an advanced space-based long wavelength infrared surveillance system for space object tracking. Near-term efforts in this program address the basic technical, background, system feasibility and utility issues to evaluate the basic system concept. These include: a measurements program that will provide indicative data on background levels and models; a major development effort on cryogenic coolers that will provide not only adequate performance, but also operate at least three years for system practicality; key sensor technology and data processing developments to evaluate the state-of-the-art; and a continuing systems evaluation including viable alternatives, and concept development to understand the system issues such as life cycle cost, deployment, survivability, performance and assess changes in the requirements (see Descriptive Summary on Project 2698 for details).

The space-based system can provide

this system offers increased survivability and is not subject to the difficulties and uncertainties of foreign basing. Furthermore,

RELATED ACTIVITIES: This program is part of a singly managed Space Defense Program involving four functional areas: antisatellite, space surveillance, space survivability, and command and control. Program Element (P.E.) 64406F, Space Defense System, provides an

P.E. 63438F, Satellite Systems Survivability, provides on-board sensors which assist in the satellite attack verification function of this program which provides the required warning time needed for some survival aids such as maneuvering. The Defense Advanced Research Projects Agency's Space Object Identification Program and the Tactical Assessment of Satellite Mission Program under the Space Surveillance Program are integrated and have common technical management agencies. P.E. 12424F, United States Air Force SPACETRACK, incorporates the research and development efforts of this program into the operational SPACETRACK system. P.E. 12311F, NORAD Combat Operations Center, will provide the command and control for these programs.

(U) WORK PERFORMED BY: Headquarters, Space Division, Los Angeles, CA, is responsible for overall management of the program. A.D. Little Corporation, Cambridge, MA: cryogenic cooler. Hughes, Culver City, CA: cryogenic cooler and long wavelength infrared sensor; TRW, Redondo Beach, CA: ground electro-optics moving target indicator. Aerospace Corporation, El Segundo, CA; Lincoln Laboratory, Lexington, MA; and MITRE, Boston, MA, provide general systems engineering.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (S) FY 1980 and Prior Accomplishments: Cryogenic cooler efforts were conducted with life testing for the Vuillemeir cooler and performance testing of a two-stage rotary reciprocating refrigerator. In FY 1976 both the tactical

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

assessment of satellite mission efforts and the long wavelength infrared probe efforts were initiated. The experimental prototype ground-based electro-optics site at White Sands Missile Range started operation in August 1975 and has completed initial sensor and moving target indicator testing. Design studies were conducted for a ground-based radar system and a multimission space-based radar. A contract was awarded in Fiscal Year (FY) 1976 for development of a Satellite Attack Warning and Verification software system with initial system algorithms tested in FY 1978 and transition in FY 1979 to the Air Defense Center. Development testing was completed for calibrating existing SPACETRACK radars using the Navy navigation system and for extending the tracking range of several radars to 22,000 nautical miles (nm) through the use of

Contracts were awarded for the Space Infrared Experiment and the program has produced hardware for testing. In FY 1979 the space experiment host spacecraft, developed by the Space Test Program, Program Element (P.E.) 63402F, was terminated and the space experiment program was converted to a Shuttle sortie mission. Design changes for the space experiment sensor were initiated. The initial satellite hardware will be tested and put into storage until a Shuttle mission and pallet are available. An expanded performance and reliability program on the Vuillemeir cryogenic cooler was initiated for the space experiment. Component design was initiated for a three-stage rotary reciprocating refrigerator. The sensors and probes for the long wavelength infrared measurements were procured and are in the later stages of design, fabrication and testing. Two probes have been launched. One failed due to rocket problems and one was a complete success. The HAYSTACK imaging radar development and transition were initiated. The ALCOR imaging radar transitioned in FY 1978. These radars provide

The prototype ground-based electro-optical site was developed and conducted sensor reliability and other testing to support procurement of the operational system (P.E. 12424F, SPACETRACK) (see Descriptive Summary for Project 2698). A mathematical model was developed to support the United States antisatellite targeting and Satellite Attack Warning mission analysis. A surveillance architecture for upgrading the SPACETRACK system was completed. A program was initiated to

A new program office was formed integrating the surveillance, antisatellite, survivability and command and control functions to be more responsive to Presidential and Secretary of Defense directives.

2. FY 1981 Program: The Vuillemeir cryogenic cooler performance reliability test program will continue. Fabrication of a rotary reciprocating three stage refrigerator and advanced Vuillemeir cooler will be continued. Three long wavelength infrared probe launches are planned. The integration and improvement of assets for the tactical analysis of satellite missions will be continued. The initial HAYSTACK imaging radar development will be completed. Testing of the ground-based electro-optical, experimental test site systems will be completed and transitioned to P.E. 12424F, SPACETRACK. The space experiment testing will be completed along with continued data processing development and testing (see separate Descriptive Summary for Project 2698). The redesign for the Shuttle sortie will continue. The SPACETRACK model will be maintained to allow for trade-offs in system performance as changes occur. Orbital prediction improvements to support!

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

3. FY 1982 Planned Program: The space experiment payload redesign will be continued along with mission planning. Several activities will be continued at reduced levels in the FY 1982 time frame including: tactical assessment of satellite mission improvements and transition; space-based surveillance system concept studies; software development for improved SPACETRACK targeting; and integration of efforts in this period will be the redesign of the space equipment, cryogenic cooler performance and three-year life testing, and system concept formulation. The probe launches will be continued. The FY 1982 funding was reduced due to other higher priority efforts.

4. FY 1983 Planned Program: The program will continue and expand the near-term improvements. The Space Infrared Experiment effort will continue. The probe launches will be completed and the results analyzed and provided to the and for the surveillance system design. The major space-based surveillance system designs will be initiated.

5. Program to Completion: The long wavelength infrared efforts will lead to a 1984 Defense System Acquisition Review Council I decision on the configuration and requirements for the space-based system.

Satellite Attack Warning requirements and threat growth will, coupled with the system development results, provide the decision data base. The system will be launched in

6. Milestones:

Date

- a. Defense Systems Acquisition Review Council
- b. Satellite Launch

FY 1984

Project: 2018

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Systems Development

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

DETAILED BACKGROUND AND DESCRIPTION: The efforts under this project are those system oriented tasks that are specifically designed to

Currently, satellites

(U) This project is divided into two basic efforts. First is the testing of an experimental ground electro-optical site that is used as the prototype for development of a near-term, low risk, five site Global Ground Electro-Optical Deep Space Surveillance System under Program Element 12424F, SPACETRACK. This system will immediately increase the detection altitude to 22,000 nm and will cover the geosynchronous belt; however, with limited response time due to weather and nighttime background constraints. The experimental site, located at White Sands Missile Range, NM, has been operating since August 1975 and will terminate operations in Fiscal Year (FY) 1981 when it will be replaced by a full Ground Electro-Optical Deep Space Surveillance site.

The second effort is the development of a satellite system for the late 1980's to reduce the need for overseas and vulnerable remote bases, improve high altitude coverage and range for the whole celestial sphere, and to reduce Soviet satellite and antisatellite detection time to near real-time so that high confidence warning of an attack on United States (U.S.) satellites can be provided in sufficient time to exercise a political or military response. This program will also provide more technology and background data are not available to develop or evaluate this system in the near-term. Technology is being pursued for the experimental development of a space-based long wavelength infrared system that detects a satellite's emitted heat. Several systems were compared for performance, coverage and cost with this space-based system. The long wavelength infrared system was selected as the primary system for satisfying the needs.

(U) Preliminary satellite surveillance system concepts were developed during FY 1975. These preliminary studies provided a conceptual basis for the program and identified the specific technological and background issues and areas of concern, along with a preliminary development road map. The infrared background probe measurements program, cryogenic cooler and sensor developments, space infrared experiment and a surveillance architecture program were formed to specifically address the critical path areas, provide for a system level demonstration experiment and evaluate the system utility. Design concepts may be investigated at a low level under this project for advanced microwave, visible and alternate infrared systems as potential backups to support this mission and assure the program is current.

RELATED ACTIVITIES: Provides

In Program Element 63438F, Satellite Systems Survivability, the "On-Board Sensors" effort, when

Project: 2698

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Systems Development

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

Integrated with this program, provides an integrated capability to warn of or verify an attack on a satellite. Defense Advanced Research Projects Agency's Space Surveillance Program is integrated with these efforts. Program Element 12424F, United States Air Force SPACETRACK, will deploy a five-site ground electro-optics system and other improvements based on technology from this project. The Space Infrared Experiment will be flown by the Space Test Program (Program Element 63402F).

(U) WORK PERFORMED BY: Headquarters Space Division, Los Angeles, CA, manages this project. The Electronic Systems Division and Air Force Geophysical Laboratory, Hanscom AFB, MA, and Rome Air Development Center, Rome, NY, manage selected tasks within the individual projects. The contractors for ground and space-based system development include Westinghouse Electric Corporation, Baltimore, MD; TRW, Redondo Beach, CA; Hughes, Culver City, CA; MIT, Lincoln Laboratory, Lexington, MA; Lockheed Missiles and Space Company Incorporated, Sunnyvale, CA; Rockwell International Corporation, Seal Beach, CA; MITRE Corporation Bedford, MA; Aerospace Corporation, El Segundo, CA, and Science Applications Incorporated, La Jolla, CA. The Aerospace and MITRE Corporations provide general systems engineering.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The ground-based electro-optics site at White Sands Missile Range started operation on 30 August 1975. An advanced electro-optical tube was developed and tested. Four competing moving target indicator techniques were developed and tested. A 31-inch telescope and a 14-inch telescope were used in the prototype configuration. The development of the procurement package and specifications for the five site operational system was conducted in Fiscal Year 1977 and a contract was awarded in May 1978 under Program Element 12424F, SPACETRACK. During this period through Fiscal Year 1981 the ground-based electro-optical test site at White Sands Missile Range was dedicated to supporting the operational system procurement and developing improvements in software and sensors (some developed by the Defense Advanced Research Projects Agency) as potential block changes to the operational system. The test site supported operational site development in areas such as sensor reliability testing and system maintenance. This site also serves as the primary high altitude detection sensor for SPACETRACK until the first operational site becomes fully functional in.

Several space-based system concepts employing a long wavelength infrared sensor were analyzed to determine background, target and technology data required to evaluate the concept. To meet these requirements and because adequate infrared data cannot be gathered on the ground, a three part technology and measurement program was initiated. The first effort had a background measurements program initiated in 1976. Three types of background data are needed including infrared data on stars (celestial data), the earth's atmosphere (Earthlimb data) and the solar plane (Zodiacal data). Seven probes were initially planned, later expanding to ten. Three different sensors were required and were developed starting in Fiscal Year 1976 using two modified sensors and one new sensor. This program was to provide early indicative data to bound system technology development and provide critical background data for the United States

Two probes have been launched. The first (celestial) probe failed due to a rocket failure. The second (Zodiacal) was completely successful.

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Project: 2698

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Systems Development

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

(U) The second effort is a space experiment to be flown as the primary experiment on a Space Test Program (Program Element 63402F) Shuttle sortie flight. The title of the effort is Space Infrared Experiment (SIRE).

The payload was initially scheduled as a one year satellite mission to be launched in Fiscal Year (FY) 1981; however, the satellite was terminated in FY 1979 and SIRE was restructured to the Shuttle sortie mission in FY 1983. This flight has been further slipped to the mid 1980's due to a change in the Space Test Program (see Descriptive Summary for PE 63402F). The primary payload elements are a modification of a state-of-the-art sensor; a high sensitivity, experimental focal plane; a cryogenic cooler; a gimbal system and heat rejection system. A detailed System Design Review was accomplished to establish experimental goals consistent with hardware realities. The design and fabrication were completed at the time of the satellite termination. The completed sensor was successfully fabricated but will require extensive redesign to fly captively on the Shuttle. This experiment will provide detailed systems background and extensive data for both the long wavelength infrared surveillance system and United States

Alternatives for earlier flights are being examined and will be implemented, if possible, to save total cost and better support the antisatellite program data requirements.

(U) The third program is the satellite surveillance systems technology, primarily cryogenic coolers, although some other work is included. These surveillance systems are dependent upon detection sensors of high sensitivity which require cooling as low as ten degrees Kelvin. To obtain the requisite cooling, cryogenic coolers must be developed which provide adequate performance and are sufficiently long-lived to make an operational system cost effective. The objective of this effort is to develop and demonstrate the cryogenic cooler technology and reliability for the surveillance system. Cryogenic coolers for this application represent a significant departure from other Air Force cryogenic cooler work because they operate near absolute zero (versus 50 degrees Kelvin), in space, and for at least three years without maintenance. This program also supports a near-term requirement for a space qualified cooler for the space infrared experiment and the development of thermal management techniques for the system's three to five year requirement.

2. (U) FY 1981 Program: The ground-based electro-optical development and test program will be completed and be replaced by a full Ground Electro-Optical Deep Space Surveillance System site for operational transition to the Aerospace Defense Command.

(U) The SIRE payload hardware will be tested and redesign continued as the Shuttle interfaces are defined. Special Shuttle design requirements, such as contamination control, must be accommodated along with detailed interface definition for the planned Space Test Program standard test pallet. Mission planning will be conducted along with the definition of changes to the data reduction program.

(U) The prototype technology development activities will continue with limited long lead sensor developments using the results of the probe measurements. The cooler reliability testing and development will continue. Three additional probe launches are planned. System concept studies will continue.

Project: 2698

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Systems Development

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

3. (U) FY 1982 Planned Program: All efforts will be slowed in FY 1982 due to funding constraints. The Space Infrared Experiment (SIRE) Shuttle integration studies will be continued and the interface will be investigated. The data processing/reduction program will be rescoped for the Shuttle launch. Some of the technology programs to support the operational system decision will continue at a low level. These include: cooler development and testing, probe measurements and component technology investigations. Preparation of a procurement package will be initiated for a major system/concept development starting in FY 1983. All these efforts are focused to provide the basis for a Defense Systems Acquisition Review Council (DSARC) I milestone in FY 1984.

4. (U) FY 1983 Planned Program: Efforts will be expanded to proceed with improvements and transition of ground system upgrades and increase technology and system development work for the space-based system. The SIRE modifications will continue for the Shuttle launch with emphasis on interface requirements. The probe program launches will be completed and data analysis will continue. The cooler program will be expanded to gain more data on reliability and evaluate alternate cooler hardware concepts.

5. Program to Completion: The near-term improvements to SPACETRACK will be completed in the mid 1980's. These results, coupled with the results of the Space Infrared Experiment flight, long wavelength infrared concept, technology and design results, and updated threat projections; will be the basis on which a far-term system surveillance concept will be selected for prototype development. This DSARC I review and decision will occur in late FY 1984 for a prototype launch in

6. (U) Milestones: Not applicable

7. (U) Resources:

EDT&E Funds

34,000

33,400

27,900

39,800

Continuing

Not applicable

FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
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336 380 380

Project: 2698

Program Element: # 63428F

DoD Mission Area: Space Defense, # 123

Title: Systems Development

Title: Space Surveillance Technology

Budget Activity: Strategic Programs, # 3

8. (U) Comparison with the FY 1981 Descriptive Summary:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
RDT&E Funds	34,000 ¹	38,500 ¹	50,600 ¹		Continuing	Not applicable

There was a major funding change in the FY 1982 President's Budget from the FY 1981 Descriptive Summary estimate. The major change was due to the Space Test Program restructuring of the Space Infrared Experiment (SIRE) from a free-flying spacecraft to a Shuttle sortie and the extended delays of the Space Test Program launch. This necessitated major redesign of the near completed payload for a significantly different host environment. The additional cost to accomplish the change was taken from within this program, specifically the operational development, resulting in a program and operational system delay of about four years.

1/Different project breakout in these years

(381 382 B)

337 381-382 B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63429F

DoD Mission Area: Strategic Information Systems, #134

Title: Warning Information Correlation
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs	
TOTAL FOR PROGRAM ELEMENT								
2490	Threat Development	4000*	2970	0	0	0	0	Not Applicable
2491	Sensor Interface	800	1000	0	0	0	0	Not Applicable
2492	System Development	300	650	0	0	0	0	Not Applicable
		2900	1320	0	0	0	0	Not Applicable

* Reflects recent reprogramming action of +\$2900 thousand.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Warning Information Correlation program studies, evaluates and defines the scope of improved warning, attack assessment, communications, processing systems, and displays for tactical warning and attack assessment information. The information is required by the National Command Authorities and the primary nuclear Commanders-in-Chief for strategic force management, and during crisis and conflict to initiate survival actions, control escalation, terminate hostilities, and manage the strategic reserve force.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Program not funded due to higher priority needs.

(U) COMPARISON WITH FY 1981 BUDGET DATA:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion Continuing	Total Estimated Costs	Not Applicable
RDT&E	3600	3000	6600				

(U) OTHER APPROPRIATION FUNDS: Not Applicable

DETAILED BACKGROUND AND DESCRIPTION: The United States Air Force missile attack assessment program began during the 1973-1975 period. At that time the Air Force

However, during 1975 under Program Element 63429F, then called

Program Element: #63429F

DoD Mission Area: Strategic Information Systems, #134

Title: Warning Information Correlation
Budget Activity: Strategic Programs, #3

the Attack Assessment System, initial software was designed and tested using Ballistic Missile Early Warning System detection radar data which provides an estimated count and impact predictions

However, this data's utility

the algorithms were

Although

This initial capability was installed at North American Air Defense Command's Cheyenne Mountain Complex In Fiscal Year 1977, Program Element 63429F was directed to analyze current and proposed sensors (Ballistic Missile Early Warning System, Perimeter Acquisition Radar Attack Characterization System), Integrated Operational Nuclear Detection System, and Integrated Operational Nuclear Detection System, to identify specific improvements that would contribute to improved, high confidence, integrated attack assessment. In order to understand the sensors and test concepts a simulator program was initiated and test tools developed. Recommendations for improvements were made which, together with the Air Force's Missile Warning Study (1978), provided the basis for the sensor improvement program initiated in 1979. The Warning Information Correlation Program also initiated systems studies concerning processing and display concepts as well as requirements and operations concepts for an improved Attack Assessment system. This program is directed toward providing capabilities to meet the Office of Joint Chiefs of Staff requirements for attack assessment and supporting valid North American Air Defense Command's requirements for continental United States and world-wide tactical warning and attack assessment using The extension of these capabilities for potential force management roles will also be pursued.

(U) RELATED ACTIVITIES: This program provides Research, Development, Test, and Evaluation support for improved missile warning and attack assessment software and display in support of the Department of Defense's World-Wide Military Command and Control System. The Air Force program, AF/WMCCS, PE 63735F, develops the overall architecture for all command and control functions from sensor to user, end-to-end, to include communications and survivability. Supporting this architecture, the Warning Information Correlation program provides specific Tactical Warning and Attack Assessment design for integration into the common user computer and display system - Command Center Processing and Display System, PE 12436F. PE 12436 in turn provides the computer and display hardware and implements improved software packages into the system at the National Military Command Center and its alternate, into the Strategic Air Command's command post, and into the North American Air Defense Command's Cheyenne Mountain Complex. In addition to its integral coordination with the World Wide Military Command and Control System, and the Command Center Processing and Display System, the efforts in the Warning Information Correlation program are closely aligned with the sensor system programs. This program evaluates and develops general design specifications for coherent, integrated use of warning data from a variety of sensors (both space and ground based); evaluates the survivability and transmission of this data from sensor to command center, and considers processing and display techniques which assure reliable and usable information is available at the command centers and commands.

Program Element: #63429F

DoD Mission Area: Strategic Information Systems, #134

Title: Warning Information Correlation

Budget Activity: Strategic Programs, #3

(U) WORK PERFORMED BY: Electronic Systems Division, Bedford, MA, is the System Program Office. Space Division, Los Angeles Air Force Station, Los Angeles, CA, is also a participant. Contractors include TRW System Group, Redondo Beach, CA; Kappa Systems, Inc., Colorado Springs, CO; General Research Corporation, Santa Barbara, CA; Teledyne-Brown Engineering, Huntsville, AL; Logicon, San Pedro, CA; Lincoln Laboratories, Bedford, MA; Aerodyne Research Inc., Bedford, MA; and MITRE Corporation, Bedford, MA. Other contracts will be awarded by using competition.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: In April 1976, the Warning Information Correlation Program delivered the current North American Air Defense Command's

In 1977, recommendations were provided for sensor upgrades, and sensor and command center simulators for analyses, development, and test usage were developed. In 1978, initial work was completed for specification of improved missile warning and Attack Assessment, on operational concepts, and on required in support of software/sensor design. Threat work was expanded in 1979 along with new efforts initiated for data processing concepts and data distribution. In 1980, threat work was continued and sensor simulators were updated to represent proposed sensor improvements. Outstanding issues such as discrimination, data base requirements, system architecture trades between sensor and rearward user processing, system sensitivities, and data integration were investigated. Concepts, software, data bases, algorithms, and design specifications were pursued to support improved Attack Assessment. Five volumes, of the seven volume set, of Tactical Warning and Attack Assessment Architecture were developed.

2. (U) FY 1981 Program: The Fiscal 1981 effort is directed to design, test, demonstrate, and deliver improved, more reliable software and display specifications to replace obsolete equipment providing missile warning and attack assessment information. The program will also initiate competitive studies directed toward reconstitutable warning sensors to focus related efforts by other services and agencies within the total system context. The Tactical Warning and Attack Assessment Architecture will be completed and the near and mid-term threat models will be completed.

3. (U) FY 1982 Planned Program: Not Applicable

4. (U) FY 1983 Planned Program: Not Applicable

5. (U) Program to Completion: Not Applicable

6. (U) Milestones: Not Applicable

385-386B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Advanced Space Communications
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	34,499	27,000	51,500*	63,400	Continuing	Not Applicable
1227	Terminal Segment Technology	12,599	7,300	9,000	7,300	Continuing	Not Applicable
2028	Space Segment Technology	13,800	12,000	14,200	14,400	Continuing	Not Applicable
2029	System Analyses/Demonstration	8,100	7,700	28,300	41,700	Continuing	Not Applicable

* \$16.1 million from AFSATCOM, PE 33601F, will be used to support the FY 1982 effort described in this Descriptive

Summary for studies and advanced technology efforts to precede future communications satellite solutions for strategic, tactical, and intelligence users. Request these funds be transferred to PE 63431F, Project 2029.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element is the only Air Force program for advanced development of satellite communications system concepts, techniques, and technologies. The program identifies, develops, demonstrates, evaluates, and transitions to operational systems the satellite and airborne terminal technology necessary to support global command control and data relay communications. The requirement is to provide communications that survive in electronic jamming environments.

BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 program will concentrate on the techniques, technologies, and concepts for providing future military satellite communications system solutions for the Department of Defense's strategic and tactical mobile forces. Requirements of these forces have previously been represented by the Strategic Satellite System General Purpose Satellite Communications System, and by future upgrades to the Defense Satellite Communications System. The significantly increased budget being proposed for FY 1982 reflects the critical need that exists for initiating survivable space communications systems for the Department of Defense's combat forces. The FY 1982 program and budget has been structured to allow evaluation of competing system approaches for future satellite solutions and to concentrate on the development of the microwave and technologies that will allow these future satellite solutions to be survivable in combat jamming environments. The total cost estimate for FY 1982 represents a composite of planned definition studies and technology developments that are identified under the project descriptions.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	32,900	27,000	44,200	-	Continuing	Not Applicable
Procurement	Not Applicable					

(U) OTHER APPROPRIATION FUNDS:

Not Applicable

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force is responsible for the development of the Department of Defense's military satellite communications systems. The architecture for future systems to meet the Department of Defense's evolving satellite communications requirement is developed by the Defense Communications Agency/Military Satellite Communications System Office with active participation by the Services. Near term specific satellite systems within this architecture are developed in the Air Force under separate Program Elements. This Program Element (63431F) primarily develops and demonstrates the techniques, technologies, and concepts for the next generation satellite communications systems. Future generation systems present unique technology challenges to enable high capacity military communications to survive under the stress of sophisticated electronic jamming environments. These technology challenges are pursued in this program element under three projects. The first Project (1227) concentrates on the development of the technologies required for providing aircraft with cost effective satellite terminal capabilities. Technologies included are solid state and traveling wave tube amplifiers, parabolic dish and low profile aircraft antennas, and modulators/demodulators capable of jam resistant modulation and efficient access control. These technologies and resulting systems are field tested to confirm expected operation performance. Atmospheric propagation effects measurements are accomplished in conjunction with these field tests. The second Project (2028) concentrates on the development of the technologies required for future generation communication satellites. Included are systems for supporting Nuclear-Capable Forces, High Volume/High Data Rate Command/Control requirements and the tactical/mobile users. Associated technologies include solid-state amplifiers, satellite processors and antennas, higher frequency band components and satellite-to-satellite data-relay subsystems. The third Project (2029) accomplishes preliminary system analyses from which future airborne, ground, and space requisite technologies can be identified. A primary concentration of these system analyses will be future military satellite communications system solutions for the strategic and tactical/mobile forces. This last project further consider the integration of multiple technologies for ground-based or orbital testing.

(U) RELATED ACTIVITIES: The technologies and concepts developed in this program will be transitioned to operational systems for implementation. These systems are represented by the Air Force Satellite Communications Program (PE 33601F), the Defense Satellite Communications System (PE 33110F), and in the future by a new system to support the tactical/mobile forces. Satellite communications system planning and technology development are coordinated within the Air Force among other communication technology development program elements and with Army and Navy companion efforts: Navy - Navy Satellite Communications, Project 0728, Extremely High Frequency Satellite Communications (PE 33109N); Army - Tactical Satellite Communications Systems (PE 33142A, Project D456).

WORK PERFORMED BY: This program and Projects 2028 and 2029 are managed by Air Force Systems Command, Space Division, Los Angeles, CA. Project 1227 is managed by Rome Air Development Center, Griffiss AFB, NY. Facilities supporting these efforts include: the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; the Electronic Systems Division, Hanscom AFB, MA; and the Air Force Weapons Laboratory, Albuquerque, NM. Supporting commands include Air Force Communications Command, Scott AFB, IL, for operational planning and Electronic Security Command, Kelly AFB, San Antonio, TX, for

The
Advanced Space Communications program involves approximately eighty current or planned separate contracts. Major contractors are: McDonnell Douglas Aircraft Corporation, St. Louis, MO, for the space laser communications program; TRW Systems Group, El Segundo, CA, and Hughes Aircraft Company, Culver City, CA, for solid state amplifiers;

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

Linkabit Corporation, La Jolla, CA, for terminal modems; Raytheon Corporation, Wayland, MA, for a dual frequency terminal; and Ball Brothers, Boulder, CO, for conformal aircraft antennas. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA; the MITRE Corporation, Bedford, MA; and Lincoln Laboratory, Bedford, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Lincoln Experimental Satellites 8 and 9 were successfully launched (March 1976) and evaluated. Technologies demonstrated included extremely high frequencies, advanced frequency hopping modulations, satellite-to-satellite cross-links, and nuclear prime power sources. A Dual Frequency (extremely high and super high frequencies) terminal for command post aircraft was developed and testing accomplished with the Lincoln satellites. This type of terminal will allow operations through the Defense Satellite Communications System at super high frequencies and through future satellite payloads for the mobile forces at extremely high frequencies. Development was initiated on a smaller and lighter version super high/extremely high frequency airborne terminal for command post applications. This terminal will weigh approximately 1,200 pounds in comparison to the existing 5,500 pound super high frequency Airborne Command Post Satellite Communications Terminal. A Command Post Modem Processor development was initiated that will provide for command post control of simultaneous multiple channel communications through different satellite systems. A Solid State Ultra High Frequency Airborne Amplifier was developed, delivered and tested. This amplifier will increase force element aircraft transmit power from 100 watts to 1,000 watts. A demonstration Space Laser Communications System successfully completed laboratory testing and was transferred to the White Sands Missile Range for ground and airborne demonstration tests. A first phase of airborne communications tests, originally planned for three months duration, was completed in two weeks. A full one gigabit per second data rate link has been operating routinely from an EC-135 aircraft to a ground-based terminal (which simulates a future satellite payload). Design and fabrication was initiated on a Laser Space Measurement Unit to fly in FY 1984 on a host satellite to support data link acquisition and propagation tests. Laboratory fabrication of extremely high frequency spacecraft technologies was accomplished. These technologies, including satellite antenna and processor components, and solid state amplifiers, will be needed in future generation military satellite communication systems for protection against electronic jamming. In the planning arena, the Air Staff provided the major commands with direction to broaden the scope of the Advanced Space Communications program to provide a comprehensive planning base within the Air Force for providing future satellite solutions to the Department of Defense's space communications and data relay needs.

2. FY 1981 Program: A detailed program plan and technology roadmap will be generated for the Advanced Space Communications program reflecting the broadened scope initiated in FY 1980. This program plan and technology roadmap will be coordinated within the Department of Defense and represent the game plan for the expanded FY 1982 and beyond program. Initial concepts for future military satellite communications and data relay solutions will be explored for the strategic and tactical forces. Fabrication and testing of extremely high frequency spacecraft technologies will continue (at a constrained pace due to limited FY 1981 funding). The Command Post Modem Processor and the small super high frequency/extremely high frequency airborne terminal will be integrated into an EC-135 aircraft at Wright-Patterson AFB, OH, and flight testing initiated. The aircraft flight test program for laser communications demonstrating the will be completed. Development of the Laser Space Measurement Unit will continue for launch in FY 1984.

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

3. FY 1982 Planned Program: An expanded program to define space communications systems and develop technology will be implemented based on the coordinated program plan and technology roadmap generated during FY 1981. Specific emphasis will be on future military satellite communications solutions for the strategic and tactical forces. The scope of the effort will, however, encompass the total space communications and data relay requirements of the Department of Defense and is expected to yield a comprehensive architecture that will address the needs of the military through the turn of the century including near term strategies for transitioning selected combat forces' communications to the future extremely high frequencies. Multiple contractor efforts will be undertaken in FY 1982 to identify and define specific system approaches for satellites and payloads within the overall architecture structure. Expanded development of extreme high frequency subsystems (i.e. processors, power amplifiers) for the satellite segment will take place following the constrained pace during FY 1981. Airborne testing will continue on the Command Post Modem Processor and the small super high frequency/ extremely high frequency terminal. Development will commence on satellite terminal technologies for tactical aircraft application/installations. The Laser Space Measurement Unit will be delivered to the host spacecraft contractor for subsequent integration. Detailed design and technology development will be accomplished for an

The FY 1982 cost increase over the FY 1981 level is primarily attributable to the urgency for defining future satellite communication solutions and technologies for the tactical and strategic forces and the need for

4. FY 1983 Planned Program: Based on the space communications and data relay architectural and systems definition efforts of FY 1982, specific implementation objectives will be pursued to a next level of detailed design. Where possible, these detailed design efforts will be transitioned to acquisition program elements or new program elements initiated. Development and demonstration of key Extremely High Frequency technologies will continue. The tactical aircraft terminal technology developments will accelerate. Airborne testing of the Command Post Modem Processor and small Super High Frequency/Extremely High Frequency terminal will be completed. The Laser Space Measurement Unit payload will be integrated and tested with the host spacecraft. Detailed design and technology development towards an will continue.

5. (U) Program to Completion: This is a continuing technology development program. Component and communication subsystem development will continue to provide the requisite techniques, technologies, and concepts for future military satellite communications systems capable of surviving in the face of sophisticated electronic jamming environments.

6. (U) Milestones: Not Applicable

(390)

390

344

Project: #1227

Program Element: #63431P

DOD Mission Area: Strategic Communications, #133

Title: Terminal Segment Technology

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The military services, the Commanders-in-Chief of the Unified and Specified Commands, and the National Command Authorities require airborne command, control and communications (C3) terminals that permit operation through designated satellite systems for command and control of United States force elements. Emphasis is placed upon increased survivability, performance and reliability for Single Integrated Operations Plan execution and management, crisis management and contingency operations. This project evaluates space communications system airborne terminal requirements (Army has the ground terminal development responsibilities for the services) and develops concepts to meet these needs; evaluates the technology available to implement the concept and determines what additional technology development is required; conducts simulation and concept evaluation efforts; and assists operational systems in planning for evolutionary improvements in capability. These efforts support development of an integrated set of satellite communications capabilities for all defense requirements and insures that the technology development required to reduce risk is available prior to full scale development decisions.

(U) RELATED ACTIVITIES: This project supports the planning activity for evaluation of space communications systems, including the Air Force Satellite Communications System and the Strategic Satellite System, PE 33601P; the Defense Satellite Communications System, PE 33110P; and future tactical satellite communications systems. The technology and systems planning are coordinated with Army and Navy terminal development efforts, in conjunction with the Defense Communications Agency/Military Satellite Communications System Office, which is responsible for overall architecture of satellite communications systems. Direct coordination with the systems program offices is used to insure responsive planning and to avoid overlap.

(U) WORK PERFORMED BY: This project is the responsibility of Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA, Rome Air Development Center, Griffiss AFB, NY, and Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH. Facilities supporting this project include the Communications Simulation and Evaluation Laboratory (CSEL) at Air Force Wright Aeronautical Laboratories, and flight vehicle test beds from Aeronautical Systems Division at Wright-Patterson AFB, OH. This project has approximately 20 contracts active or planned. Major contractors include: Raytheon Corporation, Wayland, MA, for dual frequency terminals; Linkabit Corporation, La Jolla, CA, for terminal modulator/demodulator; Ball Brothers, Boulder, CO, for conformational antennas; Signatron, Bedford, MA, for Communications Simulation and Evaluation Laboratory maintenance; Computer Science Corporation, Falls Church, VA, for CSEL interface modifications; and RCA, Camden, NJ, Collins Radio Group, Dallas, TX, and Sylvania, Boston, MA, supporting propagation testing. Federal Contract Research Support is provided by the MITRE Corporation, Bedford, MA.

Project: #1227

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Terminal Segment Technology

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Lincoln Experimental Satellites 8 and 9 ultra high frequency and extremely high frequency airborne terminals have been successfully demonstrated from an airborne platform. A Dual Frequency Terminal (extremely high and super high frequencies) for command post aircraft was developed and testing completed. Development was initiated on a small super high frequency/extremely high frequency airborne terminal weighing approximately 1,200 pounds in comparison with an existing 5,500 pound terminal with similar performance. A Command Post Modem Processor development was started for eventual control of command post satellite communications activities. A Solid State Ultra High Frequency Airborne Amplifier was developed. Development has been initiated on a super high frequency Conformal Aircraft Antenna to provide a low drag installation for potential replacement of parabolic dishes with protruding radomes.
2. (U) FY 1981 Program: A comprehensive assessment will be conducted of the applications of satellite communications for current and planned operational aircraft. A technology development program will be structured for strategic and tactical aircraft compatible with space communications architecture efforts in Project 2029. The Command Post Modem Processor and the small super high frequency/extremely high frequency airborne terminal development will be integrated into an EC-135 aircraft at Wright-Patterson AFB, OH, and flight testing initiated. The super high frequency Conformal Airborne Antenna development will continue.
3. (U) FY 1982 Planned Program: An expanded technology development program will be initiated for strategic and tactical aircraft based on the FY 1981 developed program plan. Airborne testing will continue on the Command Post Modem Processor and the small super high frequency/extremely high frequency terminal. The super high frequency Conformal Airborne Antenna will be integrated on the Wright-Patterson AFB EC-135 test aircraft for tests. Development of an extremely high frequency low profile antenna will be initiated.
4. (U) FY 1983 Planned Program: The expanded technology development program for strategic and tactical aircraft will continue. Flight testing of the Command Post Modem Processor, small super high frequency/extremely high frequency terminal, and super high frequency Conformal Antenna will be completed. Full scale development for both the processor and the terminal will then commence in PE 33601F, Air Force Satellite Communications System, leading to an operational capability in the Air Force's command post aircraft. Development of an extremely high frequency low profile antenna will continue.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable

Project: #1227

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Terminal Segment Technology

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDTE	12,599	7,300	9,000	7,300	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDTE	9,600	7,500	8,500	-	Continuing	Not Applicable
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Project: #2028

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Space Segment Technology

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The military services, the Commanders-in-Chief of the Unified and Specified Commands, and the National Command Authorities require global, secure, jam-resistant and survivable satellite communication throughout the spectrum of war, including Single Integrated Operations Plan execution and management, theater conflict management, crisis management, and contingency operations. Satellites provide significant advantages in terms of survivability and global coverage without dependence upon foreign based assets. This project develops configurations, subsystems, and components for spacecraft to meet identified technology requirements of new or improved space communication systems. Development is initiated when a detailed system concept is prepared or when a new requirement is identified which exceeds the capabilities of available technologies. Configuration development includes design of the space segment to provide increased survivability, connectivity, reliability and capacity. Space technology to support interference and jamming protection is addressed. Subsystem development includes highly advanced communications capabilities involving extremely high frequency and optical (Laser) technologies. Component development includes spacecraft communications amplifiers at the extremely high frequencies with increased power, spacecraft antennas, communication processors, and other component technology to improve reliability.

(U) RELATED ACTIVITIES: The technology developed in this project is transitioned to operational space communications programs for implementation. The Air Force Satellite Communications Program, PE 33601F, will use the technology and concept developments from this project to implement increased survivability, reliability and capability to satisfy the communications requirements of the Department of Defense's strategic force elements. Future upgrades to the Defense Satellite Communications System will be based on technologies developed in this program element. The basic technologies for improved support of tactical forces will be developed within this project.

(U) WORK PERFORMED BY: This project is the responsibility of Air Force Systems Command, Space Division, Los Angeles, CA. Supporting organizations include: Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, OH; Rome Air Development Center, Rome NY; and Air Force Weapons Laboratory, Albuquerque, NM. This project has over 50 active or planned contracts. The major contractors are: McDonnell Douglas Aircraft Corporation, St. Louis, MO, for the Space Laser Communications experiment; Raytheon Corporation, Wayland, MA, for space qualified communications processor; Watkins Johnson, Palo Alto, CA, and Hughes Aircraft, Malibu, CA, for extremely high frequency (EHF) power amplifiers; Sylvania, Mountain View, CA, for a sun pumped laser; and ILC, Sunnyvale, CA, for laser pump lamp development. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA.

Project: #2028

Program Element: #63431P

DoD Mission Area: Strategic Communications, #133

Title: Space Segment Technology

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. FY 1980 and Prior Accomplishments: The Lincoln Experimental Satellites 8 and 9 were successfully launched (March 1976) and evaluated. Multi-year developments of extremely high frequency solid state satellite power amplifiers at 40 and 60 gigahertz were initiated. Twenty gigahertz solid state amplifier development work has been started. A 20 gigahertz traveling-wave-tube amplifier has been started under a joint program with the National Aeronautics and Space Administration. Laboratory fabrication of other extremely high frequency technologies was accomplished. These technologies include special anti-jam and directional antennas, on-board processors, and other devices. The 60 gigahertz development has potential application for satellite-to-satellite crosslinks. The Space Laser Communications System successfully completed laboratory testing and was moved to the White Sands Missile Range for field testing. Ground tests at White Sands were also successfully completed. Integration of the laser communications equipment into an EC-135 aircraft was accomplished for a flight test program that started in FY 1980.

The aircraft routinely operates with a one gigabit data link to a ground based terminal. Design and fabrication was initiated on a Laser Space Measurement Unit to fly in FY 1984 on a host satellite to support acquisition and propagation tests.

2. FY 1981 Program: A comprehensive development plan and technology roadmap will be generated to support an expanded technology program for future satellite communications solutions for the Department of Defense's strategic and tactical forces. Particular emphasis will be on the extremely high frequency, Close coordination will be maintained with the Defense Communications Agency/Military Satellite Communications System Office and companion terminal technology efforts of the Army and Navy. Laboratory fabrication of extremely high frequency technologies for satellite applications will continue, but at a constrained pace due to budget limitations. The laser communications aircraft flight test program

Development of the Laser Space Measurement Unit will continue for launch in FY 1984.

3. (U) FY 1982 Planned Program: An expanded technology development effort will be initiated based on the program plan and technology roadmap developed in FY 1981. The development effort will concentrate on extremely high frequency technologies for satellite application such as null steering and time hopped narrow beam antennas, on-board processors, advanced modulations, and solid-state power amplifiers. Technology performance demonstrated as a result of this year's efforts has to be sufficient to support potential acquisition decisions for future satellite systems and payloads beginning in FY 1983 (see Project 2029). The Laser Space Measurement Unit will be delivered to the host spacecraft contractor for subsequent integration.

4. (U) FY 1983 Planned Program: Extremely high frequency satellite technology development will continue. The Laser Space Measurement Unit payload will be integrated and tested with the host spacecraft.

5. (U) Program to Completion: This is a continuing program. Development efforts are focused upon increased communications capacity and survivability in the space environment.

Project: #2028

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Space Segment Technology

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RD&E	13,800	12,000	14,200	14,400	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RD&E	13,300	11,900	14,800	-	Continuing	Not Applicable
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Project: #2029

Program Element: #63431P

DoD Mission Area: Strategic Communications, #133

Title: Systems Analyses/Demonstration

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This project addresses the systems aspect of future Military Satellite Communications System solutions (new systems and upgrades to existing systems). Space segment and terminal segment requirements identified by this project are pursued in Project 1227 (Terminal Segment Technology) and Project 2028 (Space Segment Technology). The basis of the system analyses performed in this project is the architectural requirements identified by the services working with the Defense Communications Agency/Military Satellite Communications System Office. A primary concentration at this point in time is future military satellite communications system solutions for the Department of Defense's strategic and tactical combat forces. This project further considers the integration of multiple technologies for ground based and orbital testing and evaluation.

(U) RELATED ACTIVITIES: The successful accomplishment of this project calls for a close working relationship with the Defense Communications Agency/Military Satellite Communications System Office to insure the development efforts within Advanced Space Communications are consistent with the evolving MILSATCOM architectural framework. Close coordination is also required with the Army for ground terminal developments and with the Navy for shipboard terminal developments to insure compatible future system solutions. The Defense Communications Agency/Military Satellite Communications System Office provides the necessary leadership and a forum for the coordination of service technology programs.

WORK PERFORMED BY: Air Force Systems Command, Space Division, Los Angeles, CA, is responsible for this project. Supporting organizations include Electronic Systems Division, Hanscom AFB, MA; and Lincoln Laboratory, Bedford, MA. Supporting commands include Air Force Communications Command, Scott AFB, IL, for operational planning, the Air Force Geophysics Laboratory, and/

Project: #2029

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Systems Analyses/Demonstration

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Space Division accomplished the basic Military Satellite Communications alternatives analysis that resulted in the Department of Defense decision on 17 January 1977 for a three segment future architecture which included the Defense Satellite Communications System, the Strategic Satellite System, and the General Purpose Satellite Communications System. Space Division and other organizational participants also accomplished a range of system configuration alternatives for a General Purpose Satellite Communications System. Lincoln Laboratory participated in these analyses and structured a development program to address key system technologies. Space Division accomplished a first issue of a "Technology Roadmap" to guide the Advanced Space Communications development programs. Air Force Systems Command personnel participated in tri-Service working groups chaired by the Defense Communications Agency/Military Satellite Communications Systems Office to refine the details of the three segment military satellite communications architecture (published as the "Framework for MILSATCOM Development" in Nov 1978) and to define tri-Service compatible technology development goals to support the future military satellite communications architecture (published as the "Technology Development Program Plan" in Nov 1979). System approaches were investigated for providing a future military satellite communications capability for the Department of Defense's mobile/tactical forces. Driving considerations for this future capability are:

Initial steps were taken to broaden the scope of the Advanced Space Communications program, particularly in Project #2029, to provide a comprehensive planning and technology development base within the Air Force for providing future satellite solutions to the Department of Defense's space communications and data relay needs.

2. FY 1981 Program: A detailed program plan and technology roadmap will be generated for the Advanced Space Communications program reflecting the broadened scope initiated in FY 1980. This program plan and technology roadmap will be coordinated within the Department of Defense and represent the game plan for the expanded FY 1982 and beyond program. Initial concepts for future military satellite communications and data relay solutions will be explored for the strategic and tactical forces. Studies will be accomplished on orbital congestion trends (frequency spectrum and orbital positions), advanced military satellite communications concepts and applications, lease vs buy implications, and interoperability (with other United States and Allied country communications equipments). Key technologies will be integrated, either in breadboard or through simulation, to verify integrated performance characteristics. Activities in this area are coordinated with the Army and Navy advanced terminal development programs through tri-Service forums chaired by the Military Satellite Communications System Office.

Project: #2029

Program Element: #63431F

DoD Mission Area: Strategic Communications, #133

Title: Systems Analyses/Demonstration

Title: Advanced Space Communications

Budget Activity: Strategic Programs, #3

3. FY 1982 Planned Program: An expanded program of space communications system definitions and technology development will be implemented based on the coordinated program plan and technology roadmap generated during FY 1981. Specific emphasis will be on future military satellite communications solutions for the strategic and tactical forces. The scope of the effort will, however, encompass the total space communications and data relay requirements of the Department of Defense and is expected to yield a comprehensive architecture that will address Department of Defense's plans through the turn of the century including near term strategies for transitioning selected combat forces to the extremely high Detailed design and technology development will be accomplished for an

Performance measurements and assessment of integrated extremely high frequency technologies will continue, as will the (\$16.1M from AFSATCOM, PE 33601F, will be used to support the above expanded space communications system definition efforts.)

4. FY 1983 Planned Program: Based on the space communications and data relay architectural and systems definition efforts of FY 1982, specific implementation objectives will be pursued to a next level of detailed design. These detailed design efforts will be transitioned to acquisition program elements or new program elements initiated. Detailed design and technology development towards ar Performance measurements and assessments of integrated extremely high frequency technologies will continue as will the

5. (U) Program to Completion: This is a continuing systems analyses/demonstration project.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	8,100	7,700	28,300	41,700	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RD&E	10,000	7,600	20,900	-	Continuing	Not Applicable
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The increase in the estimated \$28,300 thousand for FY 1982 from last year's estimate of \$20,900 thousand primarily represents an increased commitment by the Air Force to define future military satellite communications solutions for the strategic and tactical forces.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Systems Survivability
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		28,479	31,700	11,300	44,500	Continuing	Not Applicable
2611	Survivability Architecture/Integration and Test	7,479	6,300	2,900	9,700	"	"
2612	Satellite Survivability	18,350	19,500	5,600	21,900	"	"
2613	Ground Station/Link Survivability	2,650	5,900	2,800	12,900	"	"

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The military space systems of the United States (U.S.) are critical resources of the highest national priority that support the National Command Authority and the Unified and Specified Commanders-in-Chief in peace, crisis and throughout the spectrum of war. The Soviet Union has developed, and is continuing to develop, a formidable range of threats that could deny us these resources. They have a capability to interfere with our satellite command, control, and communication links, conduct sabotage against our ground facilities, or deny us use of our overseas ground stations through political action. They have also demonstrated a low-altitude, co-orbital anti-satellite capability and the ability to interfere with our satellite sensors using ground-based lasers. In order to protect our vital space assets, a comprehensive Satellite System Survivability Program has been structured to provide the basis of a balanced capability against these threats. This program develops the necessary prototype hardware, software, technology, and operational procedures that will provide non-program unique survivability capabilities. It is the basis to assure that those functions performed by our space systems critical to our national defense survive commensurate with their planned need in crisis and war. The program is structured to provide balanced survivability between all space systems elements: satellites, data-links, and operation centers.

BASIS FOR FY 1982 RDT&E REQUEST: Updates the Space Mission Survivability Implementation Plan as a baseline survivability architecture planning document. Provides investment strategy for all Air Force space systems survivability programs. Continues systems development and integration of a prototype Adaptive Sidelobe Cancellation System for prototype system capable of Completes development of a satellite

Reduced FY 1982 funding slips all other survivability efforts a minimum of 18 months relative to schedules presented in the FY 1981 Descriptive Summary. Cost estimates are based on System Program Office analyses and contractor cost proposals.

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Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Systems Survivability
Budget Activity: Strategic Programs, #3

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RD&E	27,000	33,300	38,500	-	Continuing	Not Applicable

The significant reduction in FY 1982 funding relative to the amount shown in the FY 1981 Descriptive Summary reflects a reassessment of the priority of this program with respect to other Air Force needs.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Systems Survivability

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Space systems are required to provide critical strategic and tactical support to national decision-makers and military force commanders at all levels of conflict. They specifically provide missile attack warning, strategic and tactical navigation, surveillance, reconnaissance, forces command and control communications, and meteorological information. These systems provide support to strategic, tactical, and Rapid Deployment Forces on a global basis.

protect our space systems will most probably result in the denial of their critical support to the National Command Authority and our military forces during crisis and conflict.

Failure to

This Program Element develops prototype systems, subsystems, technologies and operational procedures for increasing the survivability of space systems (satellites, data links, and ground elements) against ground, air, and space-based conventional, nuclear, and hostile electromagnetic radiation threats. Initial integration of survivability systems into satellites and ground stations is also provided. Application of nuclear hardening technology, developed under PE 62601F, "Advanced Weapons," and PE 64711F, "Systems Survivability," is accomplished in this program. The program is divided into three projects. Project 2611 - Survivability Architecture; Integration and Test--Determines the mission requirements of Department of Defense (DoD) space systems, evaluates their vulnerability to current and future threats, and determines the most cost-effective methods to achieve required survivability. An overall Space System Survivability Architecture, including plans and programs, are developed to enhance survivability. This project also provides non-recurring funding for initial integration and test of survivability enhancements into satellites, data-links, and ground systems. Project 2612 - Satellite Survivability--Develops systems, subsystems, technology, and operational procedures to

Develops non-program unique prototype initial operational capability survivability systems (see separate Descriptive Summary for Project 2612). Project 2613 - Ground Station/Link Survivability--This project develops systems, subsystems, technology and operational procedures to counter threats against space system data links and satellite command and control ground stations.

(U) RELATED ACTIVITIES: This program is part of the larger Space Defense Systems Program involving four functional areas; Space Surveillance (PE 63428F & 12424F), Space Defense Systems and Operations (Antisatellite) (PE 64406F & 12450F), Space Defense Command & Control Operations (PE 12311F), and Space Systems Survivability (PE 63438F). PE 63428F, Space Surveillance Technology, develops advanced sensors and prototype space systems to improve the U.S. surveillance and warning information processing system to meet the evolving needs of the Space Defense Systems Program. P.E. 12424F, SPACETRACK, provides for the production, deployment, and operational integration of surveillance and command and control components into the operational inventory. P.E. 64406F, Space Defense Systems (Antisatellite) supports the development of non-nuclear antisatellite capabilities. P.E. 12450F, Space Defense Operations, provides for the production and deployment of antisatellite systems selected for transition from engineering development to the operational inventory. P.E. 12311F, NORAD Combat Operations Center, develops the Space Defense Operations Center (SPADOC) to integrate and coordinate all elements of the Space Defense Systems Program and insure the appropriate command and control functions are available to employ the satellite survivabilities countermeasures developed under this program.

Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Systems Survivability

Budget Activity: Strategic Programs, #3

WORK PERFORMED BY: The Air Force Systems Command's Space Division, Los Angeles, CA, manages this program. General Research Corporation performs survivability architecture development and program planning. The General Electric Company, Utica, New York, is developing the Modular Responsive Defense System. General Electric, Valley Forge, PA, and TRW Space and Missile Systems Group, Redondo Beach, CA, is developing the Laser Integrated Test System (managed for Space Division by the Air Force Wright Aeronautical Laboratories, Wright-Patterson AFB, Ohio). TRW is also developing a architecture. Tracor, Dallas, Texas, and Airborne Instruments Laboratory, Melville, New York, are developing a system components. Ford Aerospace and Communications Corporation, Sunnyvale, CA, is developing Ground Station and Link Survivability systems including a prototype Transportable Mobile Ground Station and a Communications Interface Processor. Hughes Aircraft Company, Fullerton, CA, is developing the Adaptive Sidelobe Cancellation System.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: An impact sensor that detects and reports a _____ attack on a satellite was developed and has been deployed on _____ were also developed. Space Mission Survivability Implementation Plans (SMSIP) were developed for all Space Division space programs. The Spacecraft Charging at High Altitude (SCATHA) space experiment was launched and analysis of data is continuing. Development of specifications began for the Space Defense Operations Center (SPADOC) to provide command and control of all space defense systems. Development of the Modular Responsive Defense System was initiated, and technology applications of _____ is continuing. The Laser Countermeasures Demonstration Program was initiated to _____ Development of an Laser Integrated Test System to test laser hardened satellite materials and countermeasures was initiated. The Ground Station and Link Survivability Program to develop prototype systems to enhance the survivability of satellite operation centers, and space system data links was also started. Concept definition and preliminary design of _____ communications system were completed. Development of a space system architecture for survival of critical space systems commensurate with requirements and the threat was also begun. Evaluation of current Department of Defense space systems to identify the most cost effective methods to achieve survivability was also initiated. A physical site security program to enhance the physical security of current DoD satellite operation centers was also begun.

2. FY 1981 Program: Develops the first Space System Survivability Architecture consisting of sub-architecture-in operation-center survivability (e.g.; physical security, satellite autonomy, network internetting), data-link survivability (e.g.; adaptive sidelobe cancellation, spread spectrum anti-jam), and satellite survivability (e.g.; reconstruction sparing, orbital placement). Completes survivability effectiveness analyses for all DoD space systems. Updates the SMSIP commensurate with the architecture and effectiveness analyses. Continues data reduction from the Spacecraft Charging at High Altitude experiment. Reorients the Modular Responsive Defense System into an development program and initiates plans to integrate the system into our space operations network. Continues the development of a _____ architecture. Begins development of a _____

Begins development of an Emergency Remote Tracking

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Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Systems Survivability

Budget Activity: Strategic, Programs #3

Station (ERTS) as a proof-of-concept, limited capability, transportable/mobile satellite command and control ground station. Accelerates development of the Adaptive Sidelobe Cancellation System. Completes preliminary design of the survivable Transportable Mobile Ground Station (TMGS) and the Communications Interface Processor for command and control ground station internetting.

3. FY 1982 Planned Program: Updates the Space Mission Survivability Implementation Plan and provides minor updates of the Survivability Architecture. Continues accelerated development of the Adaptive Sidelobe Cancellation System; Integrated Flux Receiver. All other programs delayed and reinitiated in FY 1983. The significant reduction in FY 1982 funding relative to the amount shown in the FY 1981 Descriptive Summary reflects a reassessment of the priority of this program with respect to other Air Force needs.

4. FY 1983 Planned Program: Completes a new survivability architecture and Space Mission Survivability Implementation Plans (SMSIP) update. Develops a Military Standard on spacecraft charging. Delivers the Adaptive Sidelobe Cancellation System and begins integration and test with the 46-foot Satellite Control Facility antenna at Vandenberg AFB, CA. Delivers the Integrated Flux Receiver and begins integration onto the Defense Meteorological Satellite. Continues the development of an operational Modular Responsive Defense System. Reinitiates the development of the Communication Interface Processor and Transportable Mobile Ground Station. Reinitiates physical site security evaluation and security upgrade.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones:

	Annually
a. (U) Survivability Architecture and Space Mission Survivability Implementation Plan Update	
b. (U) Adaptive Sidelobe Cancellation (ASLC) System Delivery	November 1982
c. (U) Integrated Flux Receiver (IFR) Delivery	3Qtr FY 1983
d. (U) Modular Responsive Defense System (MRDS) Critical Design Review	2Qtr FY 1983
e. (U) ASLC System Initial Operational Capability	June 1983
f. (U) IFR Launch and Test	1Qtr FY 1984
g. (U) Command Interface Processor Initial Operational Capability	2Qtr FY 1984
h. (U) MRDS Delivery	4Qtr FY 1984
i. (U) Transportable/Mobile Ground Station Initial Operational Capability	4Qtr FY 1984

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data: Not Applicable

Project: #2612

Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Survivability

Title: Space Systems Survivability

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Soviets have resumed non-nuclear satellite interceptor operations; their system can attack United States satellites within

with They can interfere

military satellites, a comprehensive program has been formulated to develop systems to provide attack warning, identify the nature and location of the attacker, and counter the attack.

In order to protect U.S.

This project develops systems, subsystems, technology, and operational procedures to

It also provides prototype/initial operational capability systems for integration onto Department of Defense satellites.

RELATED ACTIVITIES: Program Element 63428F, Space Surveillance Technology, is developing tracking systems that work with:

WORK PERFORMED BY: The Air Force Space Division manages this effort. The efforts are being performed by General Electric, Utica, NY; Tracor Aerospace Inc., Austin, Texas; Airborne Instruments Laboratory, Melville, NY; TRW, Space Systems Group, Redondo Beach, CA; and the General Electric Co., Valley Forge, PA. The Aerospace Corporation, El Segundo, CA, provides general systems engineering and technical integration.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Developed prototype earth-oriented and space-oriented proof-of-concept Modular Responsive Defense System (MRDS) capable of
Continued concept development of
opment of an Laser Integrated Test System to test laser hardened satellite materials and countermeasures. Initiated development of a
2. FY 1981 Program: Reorients the Modular Responsive Defense System into an operational prototype development program and initiates plans to integrate the system into our space operations network. Continues the development of a
3. FY 1982 Planned Program: Continues development of the Modular Responsive Defense System and the
All other programs are delayed and reinitiated in FY 1983.

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Project: #2612

Program Element: #63438F

DoD Mission Area: Space Defense, #123

Title: Satellite Systems Survivability

Title: Space Systems Survivability

Budget Activity: Strategic Programs, #3

4. FY 1983 Planned Program: and continues development of MRDS. Reinitiates laser countermeasures development and test program.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones:

a. (U)	Integrated Flux Receiver (IFR) Delivery	3Qtr, FY 1983
b. (U)	Modular Responsive Defense System (MRDS) Critical Design Review	2Qtr, FY 1983
c. (U)	IFR - Launch and Test	3Qtr, FY 1984
d. (U)	MRDS Delivery	4Qtr, FY 1984
e. (U)	Laser Integrated Test System Preliminary Design Review	4Qtr, FY 1984

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Cost Not Applicable
RD&E	18,350	19,500	5,600	21,900		

8. (U) Comparison with FY 1981 Budget Data:

RD&E	18,700	22,300	19,900	-	Continuing	Not Applicable
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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63703F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
		11,900	12,000	4,400	61,800	Continuing	To be determined
	TOTAL FOR PROGRAM ELEMENT						

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the development of an Over-the-Horizon Backscatter radar to improve our present limited capabilities for providing tactical early warning against attack on North America by bombers and air-to-surface missile carriers. Development of an Over-the-Horizon Backscatter radar to provide long-range surveillance down to the surface would: extend coverage of the coastal approaches from approximately 200 nautical miles to over 1800 nautical miles; increase warning time for survival of retaliatory forces; increase decision time for National Command Authorities; and significantly enhance redeployment options of available defense forces. In fiscal year 1982 and out-years, a second (companion) Program Element 12417F provides funding for the planned procurement of two 180 degree sites, one on each North American Coast. The sum of RDT&E funding from both Program Elements is required for the proposed deployment program. Starting in FY 1982, all RDT&E funding will be contained in a single Program Element (12417F).

(U) BASIS FOR FY 1982 RDT&E REQUEST: FY 1982 funds will be used to initiate full scale engineering development of the 60 degree northeast operational Over-The-Horizon Backscatter radar site. The existing experimental radar system, located in Maine will be modified and augmented to bring it to operational status. The experimental radar system, which is presently undergoing a one year feasibility test, will be the hardware/software baseline for operational upgrading. Prior to the scheduled October 1981 Defense Systems Acquisition Review Council, plans based on feasibility demonstration results will be developed for operational upgrading. Transmitter and receiver hardware will be modified where necessary, equipment for two additional frequency bands will be developed and integrated for full use of the high frequency spectrum, operational software will be developed and tested with the new and modified hardware, and a supportable tactical operations center will be built for interface with the Canadian and Northeast Region Operations Control Center. In addition to providing the required engineering and test support, this program also continues the level-of-effort on Over-The-Horizon Backscatter technology. These efforts are designed to maintain acceptable program risk levels by increasing our knowledge of ionospheric limitations on performance, supplementing the radar development in design areas promising high payoff, and insuring the availability of Over-The-Horizon scientific expertise.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	11,900	12,100	4,200		Continuing	To be determined

(U) OTHER APPROPRIATION FUNDS: Other appropriation funds are contained in Program Element 12417F.

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs #3

Program Element: #63703F
DoD Mission Area: Strategic Air Defense #122

(U) DETAILED BACKGROUND AND DESCRIPTION: The Continental United States Over-the-Horizon Backscatter radar system will provide long range surveillance and tactical early warning to alert National Command Authorities to potentially hostile aircraft in the coastal approaches to North America. Present and planned coastal radars are line-of-sight limited and have significant low altitude surveillance gaps. These deficiencies cause warning time to be limited by the 200 nautical mile range and very low probability of detection for aircraft taking advantage of the gaps. Development of an all altitude, long range and wide area Over-The-Horizon Backscatter radar will complement Distant Early Warning radar coverage by preventing end-runs to the east and west coastal approaches; will increase warning time to permit survival of our retaliatory forces; will increase decision time for the National Command Authorities; and will significantly enhance redeployment options of defense forces. The initial phase, development and feasibility testing of an experimental Over-The-Horizon radar, was approved by the Defense System Acquisition Review Council and concurred with by the Worldwide Military Command and Control System Council in 1974. A contract for a prototype radar system was awarded in March of 1975. Due to projected cost and schedule problems, the program was restructured in FY 1976. The restructured program reduced prototype design capabilities and scope to an experimental radar system required to conduct a real-time demonstration of technical feasibility. Operational configuration and "ilities" were deferred in implementing the design for the technical feasibility test.

(U) RELATED ACTIVITIES: The CONUS OTH-B radar system is being developed to provide all-altitude tactical early warning in support of our aerospace defense mission. Compatibility with related programs such as the Distant Early Warning Radars, the Joint Surveillance System, the E-3A Airborne Warning and Control System and air defense interceptors is planned. Related OTH system developments by the Office of Naval Research and the Naval Research Laboratory in the areas of ship detection and weather/sea state determination are monitored by the Air Force. A Memorandum of Agreement was signed by the Air Force and Navy in April of 1980 to establish a joint use equipment program for the Experimental Radar System. The Navy is using and will continue to use the Air Force Experimental Radar System for determination of simultaneous surveillance of aircraft and ships. Agreement with the Federal Aviation Agency and the Canadian Department of National Defence and Transportation exists to provide North American air traffic in-flight data. Acquisition of the operational Over-The-Horizon radars is accomplished with Program Elements 63703F and 12417F (procurement).

(U) WORK PERFORMED BY: The development of the CONUS OTH-B radar system and supporting OTH technology efforts are managed by the Air Force Electronics System Division, Hanscom AFB, MA. The radar prime contractor is the General Electric Co., Syracuse, NY. Major subcontractors include Continental Electronics, Dallas, TX, for the transmitter subsystem and TRW, Redondo Beach, CA, for the software development. Subcontractors for the site preparation and construction efforts have been awarded to local Maine contractors in the Moscow/Caratunk area (transmitter site) and in the Washington County area (receiver site). Continuing OTH Technology efforts, analysis, engineering studies and support are provided by: Rome Air Development Center, Griffiss Air Force Base, NY; SRI International, Remote Measurements Laboratory, Menlo Park, CA; Defense Electromagnetic Compatibility Analysis Center, Annapolis, MD; Naval Research Laboratory, Washington, D.C.; MITRE Corporation, Burlington, MA; Air Force Aerospace Medical Division, Brooks Air Force Base, TX; Air Force Geophysical Laboratory, Hanscom Air Force Base, MA; and the Air Force Materials Laboratory, Wright-Patterson Air Force, OH.

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Program Element: # 63/03F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System

Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The program was restructured in FY 1977 to reduce the prototype design implementation and test scope to an experimental radar required to demonstrate technical feasibility. Site preparation, erection of buildings and support services, and partial construction of the antennas were completed at both the transmitter and receiver sites in Maine. Configuration acceptance tests were completed on major hardware items, such as the transmitters, receivers, beamformer processor and the operator scopes. Software redesign was verified and coded. Technology efforts were initiated in the areas of low-sidelobe antenna development, ionospheric modeling and prediction, adaptive beamforming, and radar performance assessment/management technologies. Development of the experimental radar system was continued in FY 1979. Fabrication/delivery of major hardware subsystems and the central processor software was completed. Installation of transmitter and receiver antennas was completed. Integration and equipment verification tests were accomplished for site controller software. In-plant testing of radar subsystems was accomplished and major on-site activity was completed. Fabrication, installation and integration of major components were completed. Site construction was accomplished and on-site system level integration and testing in preparation for the feasibility demonstration were completed. Acceptance testing was delayed for two months during the World Administrative Radio Conference. Technology efforts were continued to evaluate alternative display formats and signal processing/radar control algorithms. System level acceptance tests were accomplished during the second quarter of fiscal year 1980 and the radar system was delivered to the Air Force in May of 1980. The nine month system performance test was started on 1 June and continued through the remainder of the 1980 fiscal year.

2. (U) FY 1981 Program: Technical feasibility testing will continue through February 1981. Subsequent to this nine month test, a limited Initial Operational Test and Evaluation will be conducted for the next three months. All testing is scheduled for completion in June 1981 and the remaining four months of FY 1981 will be used to prepare all materials for the October 1981 Defense Acquisition Review Council. The Experimental Radar System will be used by the Navy during the last four months of FY 1981. The Navy is using this system to evaluate their operational utility of Over-the-Horizon Backscatter technology. Experimental Radar System technical feasibility will address the following: probability of detection, relative position accuracy, velocity resolution, track maintenance, ionosphere outages, radio frequency interference susceptibility and compatibility and real-time identification and correlation of targets. The limited Initial Operational Test and Evaluation will address electronic countermeasures and will provide for an independent assessment of technical feasibility. Continued technology studies are directed at system risk reduction supporting evaluation of radar design, ionospheric modeling and characterization, and propagation prediction.

3. (U) FY 1982 Planned Program: The October 1981 Defense Acquisition Review Council will make a deployment decision on East and West Coast operational radar systems. Preparation for a full-scale development program is underway. It is planned to upgrade the experimental radar system to a fully operational 60 degree segment. The Maine transmitter and receiver facilities will be expanded and modified where necessary and improved for operational use. A separate operations center will be developed and integrated into existing communications/warning networks. Frequency heads are to be added and operational software will be developed for the transmitter and receiver integration control and for radar data processing.

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Program Element: # 63703F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System

Budget Activity: Strategic Programs, #3

4. (U) FY 1983 Planned Program: Work will continue to upgrade the experimental radar system to a fully operational 60 degree segment. Testing of new and modified hardware and software will begin.

5. Program to Completion: All development and testing will be completed in fiscal year and the initial 60 degree sector will be declared operational in the Northeast. Additional 60 degree sectors will be replicated on each coast until the two 180 degree coastal over-the-horizon backscatter radar fans are complete (FY

6. (U) Milestones:

- A. (U) System Definition Complete
- B. (U) Prototype Contract Award
- C. (U) Initiate Program Restructuring
- D. (U) Conclude Technical Feasibility Test
- E. (U) Conclude IOT&E
- F. (U) DSARC Review and Deployment Decision
- G. Initial Operational Capability (NE 60° Sector)
- H. Initial Operational Capability (East & West 180°)

Date

Nov 1973
Mar 1975
Dec 1976
Feb 1981
May 1981
Oct 1981

Budget Activity: Strategic Programs, #3

Program Element: #63703F, CONUS Over-the-Horizon Radar

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Continental United States Over-the-Horizon Backscatter radar is being developed to improve our present limited capabilities for providing tactical early warning against attack by bombers and air-to-surface missile carriers. In March 1975, a development contract for design and test of a limited coverage prototype in Maine was awarded to General Electric, Syracuse, New York. During fiscal year 1977 design of the prototype radar was essentially completed and engineering verification tests were successfully run on critical subsystems, such as the transmitter, antenna elements, and selected software packages. Due to projected cost and schedule problems, action to restructure the program was initiated and the prototype was scoped down to an experimental radar. The restructured program reduced radar capabilities and test scope to the Experimental Radar System. The Experimental Radar System was designed to demonstrate Over-the-Horizon Backscatter technical feasibility. The System Performance Test scheduled from July of 1980 through March 1980, will address probability of detection, relative position accuracy, velocity resolution, track maintenance, ionospheric outages and predictability, radio frequency interference susceptibility and compatibility and real-time identification and correlation of targets. A three month limited Initial Operational Test and Evaluation will follow the system performance test and is designed to provide an independent assessment of the experimental radar system performance objectives. Operational aspects and other "ilities" will be limitedly addressed during experimental radar technical feasibility testing. Reliability and maintainability data will be obtained and analyzed to help identify Experimental Radar System deficiencies and better characterize operational system specifications. The results of the technical feasibility demonstration are scheduled for Defense Systems Acquisition Review Council review scheduled for October of 1981.

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center will conduct three months of limited initial operational test and evaluation, from March through May 1981, on the Over-the-Horizon Backscatter Experimental Radar System. Tactical Air Command, Air Force Logistics Command, Air Force Communications Command, and Military Airlift Command/Air Weather Service will participate in the initial operational test and evaluation effort.

(U) Because the Experimental Radar System is less than a prototype, a significant amount of engineering and development work is anticipated following a Defense Systems Acquisition Review Council II decision to bring the system up to an operationally representative configuration. Because of the experimental nature of the test article, projections from limited initial operational test and evaluation of the Experimental Radar System to an operational system should be carefully structured.

(U) The primary purpose of the limited initial operational test and evaluation will be to estimate Experimental Radar System operational effectiveness and suitability, and to identify operational deficiencies requiring corrective action during Over-the-Horizon Backscatter full scale development.

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Budget Activity: Strategic Programs, #3
 Program Element: #63703F, CONUS Over-the-Horizon Radar

(U) Significant test milestones are as follows:

<u>Event/Activity</u>	<u>Start Date</u>	<u>Completion Date</u>
- System Performance Testing (technical feasibility)	June 1980	February 1981
- Initial Operational Test and Evaluation	March 1981	May 1981
- Initial Operational Test and Evaluation Final Report		July 1981
- Defense Systems Acquisition Review Council II		October 1981

(U) Initial Operational Test and Evaluation will be conducted primarily at the Experimental Radar System combined receiver/operations site near Columbia Falls, in Washington County, Maine. Some testing will take place at the transmitter site, near Moscow/Caratunk, Maine.

(U) Major Initial Operational Test and Evaluation operational effectiveness objectives include assessments of the radar's capability to detect, track, correlate, and identify targets in geographical areas of primary interest to the using command; position, velocity, and heading accuracies; Electronic Countermeasures recognition capabilities of the system; ionospheric outage predictability; and effectiveness of man-machine interfaces. During Initial Operational Test and Evaluation using command personnel will operate the consoles to provide valid estimates of the capabilities of Air Force operators to perform the Over-the-Horizon Backscatter detection, tracking, and identification functions.

(U) Operational suitability assessments will be limited to monitoring contractor-performed Experimental Radar System maintenance, evaluating software maintainability and usability, and evaluating failure data. This will provide the using command with initial estimates of Over-the-Horizon Backscatter reliability and availability. Since integrated logistics support is not planned for the Experimental Radar System, the logistics supportability assessment will be confined to a review of the contractor's logistics operations during System Performance Testing and Initial Operational Test and Evaluation.

(U) The Initial Operational Test and Evaluation will provide a limited assessment of Over-the-Horizon Backscatter operational effectiveness and suitability. Further Initial Operational Test and Evaluation will be required on a representative, prototype radar following Defense Systems Acquisition Review Council II.

Budget Activity: Strategic Programs, #3
 Program Element: #63703P, CONUS Over-the-Horizon Radar

3. System Characteristics:

Detection and Tracking Range via Ionospheric
 Skip (nautical miles)

Normal

Anomalous

Angular Sector Coverage (degrees)

Probability of Detection and Establishment of Track
 within 1200 nautical miles of Station (90 percent of the time)

Mid-Latitude percent

Auroral percent

Position Accuracy (one standard deviation)
 (nautical miles)

Absolute

Relative

Target Velocity Resolution (knots)

Objectives

500 to over 1800
 500 to 1200

60

Demonstrated

To Be Determined
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4160
 415-4168

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64226F

DOD Mission Area: Offensive Strike, # 113

Title: Long Range Combat Aircraft

Budget Activity: Strategic Programs, # 3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,000*	260,124	302,000	TBD	Continuing	Not Applicable
	* Program Element 63238F						

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Long Range Combat Aircraft is a new strategic weapon system able to perform as a conventional bomber, cruise missile launch platform, and nuclear weapons delivery vehicle in either a tactical or a strategic role. National guidance requires increased targeting flexibility which exceeds current force capabilities. The Long Range Combat Aircraft will provide a flexible, large payload delivery aircraft capitalizing on the ability to apply human judgment in real time throughout the full spectrum of conflict.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The 1982 Budget Request reflects a funding estimate pending the selection of a Long Range Combat Aircraft from among the candidates by the Secretary of Defense. The outyear funds will be dependent upon the desired Initial Operational Capability date, the Full Operational Capability date, the candidate selected, and the number of aircraft desired.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Procurement						
Not Applicable						
<u>(U) OTHER APPROPRIATION FUNDS:</u>						
Procurement (Aircraft) (PE # 11126)	0	0	2,121,000	3,599,000	Continuing	Not Applicable

Program Element: # 64226F

DOD Mission Area: Offensive Strike, # 113

Title: Long Range Combat Aircraft

Budget Activity: Strategic Programs, # 3

(U) DETAILED BACKGROUND AND DESCRIPTION: The 1981 Defense Authorization Act directed the Secretary of Defense to begin the full-scale engineering development of a new strategic aircraft with an Initial Operational Capability as soon as practicable but not later than 1987. This aircraft must be capable of performing the missions of conventional bomber, cruise missile launch platform, and nuclear weapons delivery system in strategic and tactical roles. The aircraft will be selected from several candidates to include, but not be limited to, an advanced technology aircraft, the B-1 and its derivatives, and the FB-111B/C. The Office of the Secretary of Defense status report was to be given to Congress not later than 15 March 1981 on the efforts being made to develop a new strategic bomber. An interim report was provided to the Congress in the latter part of March which reaffirmed the requirement for a bomber leg of the strategic TRIAD. It clarified the Long Range Combat Aircraft missions and the aircraft requirements needed to satisfy those missions. It also briefly discussed the leading candidates. A final report will be made by 1 June 1981 in the form of a decision by the Administration to proceed along a specific course of action. Supporting technical and cost reports will be available in connection with this announcement.

(U) A Joint Bomber Study group, with participation by members of the Air Force, Office of the Secretary of Defense, and Office of the Joint Chiefs of Staff, was formed under the Deputy Under Secretary of Defense for Research and Engineering (Strategic and Space Systems) to assist the Secretary in the selection of a new Long Range Combat Aircraft. This group has five specialized panels: missions and requirements, threat, program plan, aircraft systems design, and system evaluation. The Study will be completed by 1 May 1981. A final recommendation by the Secretary of Defense will be provided to Congress by 1 June 1981.

(U) The 1981 Defense Authorization Bill authorized \$300 million for Research and Development and \$75 million for Procurement of long lead production items. The associated Appropriations Bill supported the full Research and Development funding authorized, but not the Procurement funding. However, the Bill did provide that once the Department of Defense has made a decision on the specific aircraft to be developed, a reprogramming request will be entertained to transfer funds from Research and Development to Procurement.

(U) The 1981 Department of Defense Appropriation Act contained an undistributed Air Force Research, Development Test and Evaluation reduction of \$287.5 million. The Long Range Combat Aircraft program was reduced by \$39 million as a partial offset to the directed funding reduction. A further reduction of \$0.9 million was made to reflect new, lower defense inflation rates.

(U) RELATED ACTIVITIES: Consistent with Congressional intent, the remaining 1979 and 1980 fiscal year funds from the Cruise Missile Carrier Aircraft program element were transferred to the Long Range Combat Aircraft account. These funds were used to perform initial development tasks common to all candidate aircraft and were necessary for preparing for the vigorous initiation of a major aircraft development program. These tasks included aircraft configuration design definition including structural design and evaluation; interface definition; cost/performance/risk tradeoff analysis for major subsystems; specification preparation; and estimates of development/production costs, schedules, and aircraft performance.

Program Element: # 642267

DOD Mission Area: Offensive Strike, # 113

Title: Long Range Combat Aircraft

Budget Activity: Strategic Programs, # 3

- (U) The Bomber Penetration Evaluation (B-1) is an evaluation of the ALQ-161 electronic countermeasures suite. The Air Force Test and Evaluation Center, an independent Air Force headquarters, is conducting the evaluation of the electronic countermeasures suite in a simulated operational environment against current and projected threats. Data from this evaluation will help quantify the ability of a modern, high speed, defensive avionics system to enhance the penetrativity of a new strategic bomber during the 1980s and 1990s.
- (U) In accordance with the Office of Management and Budget Circular A-109, a Long Range Combat Aircraft Mission Element Need Statement has been submitted through Air Staff channels. This document identifies deficiencies which a new manned aircraft could remedy. This document evolved from three Strategic Air Command Statements of Need: Cruise Missile Carrier Aircraft (4-79), Near Term Manned Bomber (6-79), and New Strategic Manned Bomber (3-66 Revised). The 1980 Scientific Advisory Board Summer Study on the Long Range Combat Aircraft was also useful in determining many of the multi-role mission requirements. This Mission Element Need Statement is scheduled to be validated in April 1981.
- (U) WORK PERFORMED BY: The Long Range Combat Aircraft program is still in its formative stages because the aircraft configuration has not been selected. This program is being managed by the Strategic Systems System Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. Cruise Missile Carrier Aircraft funds from 1980 and prior years have been used by several contractors for analysis of generic Long Range Combat Aircraft characteristics. The following companies are presently under contract:
- (U) Rockwell International, North American Aircraft Division, Los Angeles, California is undertaking a major study of the common tasks of an aircraft able to conduct the many missions envisioned for the Long Range Combat Aircraft. Rockwell is also the B-1 Aircraft/Systems Integrating contractor. They are responsible for achieving design integrity and they have total integration responsibility for the development of the B-1 bomber.
- (U) Boeing Military Aerospace Company, Seattle, Washington is studying air launched cruise missile/aircraft integration requirements. Boeing is also the Avionics Subsystem Interface contractor responsible for integrating the B-1 avionics and for providing that avionic equipment which is not government furnished.
- (U) General Dynamics, Fort Worth Division, Fort Worth, Texas is under contract to support the Strategic Bomber Study.
- (U) CALSPAN Corporation, Advanced Technology Center, Buffalo, New York and LOGICON Incorporated, Strategic and Information Systems Division, San Pedro, California provide analysis assistance to the Strategic Systems Program Office.
- (U) Several government agencies are providing specialized assistance. For instance, facilities at Holloman Air Force Base, New Mexico are being used to measure radar cross-section characteristics. The wind tunnels at the Arnold Engineering Development Center, Tennessee are used for comparative analysis. The Air Force Materials Laboratory and Air Force

Program Element: # 64226F

DOD Mission Area: Offensive Strike, # 113

Title: Long Range Combat Aircraft

Budget Activity: Strategic Programs, # 3

Avionics Laboratory at Wright-Patterson Air Force Base, Ohio are also being used in the development effort.

(U) General Electric Company, Aircraft Engine Group, Cincinnati, Ohio is responsible for the design and development of the B-1 propulsion system.

(U) The Bomber Penetration Evaluation (B-1) program, is also being managed by the Strategic Systems System Program Office. The majority of the flight test is being done at the Air Force Flight Test Center, Edwards Air Force Base, California, but several other Department of Defense test ranges are also being used: White Sands Missile Range, New Mexico; Eglin Air Force Base, Florida; Point Mugu Naval Air Station, California; Utah Test and Training Range, Utah; China Lake Naval Test Center, California; Nellis Range Complex, Nevada; and others. The current Bomber Penetration Evaluation (B-1) program is being funded by the Long Range Combat Aircraft program element. An additional primary contractor is under contract in this evaluation:

(U) AIL Division, Eaton Corporation, Deer Park, New York develops and builds electronic countermeasures for the B-1 defensive avionics system.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable

2. (U) FY 1981 Program: In order to meet a 1987 Initial Operational Capability, it will be necessary to tailor existing system acquisition procedures. For instance, it is intended that the Executive Summary of the Joint Bomber Study serve as the Decision Coordination Paper and Integrated Program Summary. A Program Management Plan will be prepared prior to initiation of full-scale engineering development in fiscal year 1982. The Program Management Plan will address those Integrated Program Summary topics for which there was insufficient detail contained in the study report. Expenditure projections for the FY 1981 Program are being developed for the various alternative courses of action being examined.

3. (U) FY 1982 Planned Program: The program is dependent upon the contractor selected, the Initial Operational Capability requirement, the Full Operational Capability date, and the size of the aircraft buy.

4. (U) FY 1983 Planned Program: Program dependent.

5. (U) Program to Completion: Not applicable.

6. (U) Milestones: Current study efforts are focusing on an Initial Operational Capability date of 1987. Additional milestones are dependent on selection of final program objectives.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64312F

DoD Mission Area: Land-Based Strike, #111

Title: M-X

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	670,130*	1,491,626	2,423,200	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for the full-scale development of the advanced, Multiple Independently Targetable Reentry Vehicle Intercontinental Ballistic Missile (ICBM), M-X. Additionally, a basing mode more survivable than fixed silos will be developed because the growing quantity and quality of Soviet ICRM reentry vehicles could seriously erode United States ICBM survivability by the early 1980s. This new basing mode and improved ICBM will insure continued deterrence via increased survivability of our ICBM force.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Fabrication and ground testing will be continued on all the major missile and basing subsystems. This will include the three booster motors (stages I, II, and III), the post-boost vehicle, guidance and control, reentry system, missile transportation and handling equipment, and flight safety system. The basing vehicle subsystem will continue testing. The hardware for security and command and control will continue fabrication. Flight and targeting software design will be continued. Extensive flight and ground test planning and special test-unique hardware design will be continued. The missile and launch canister will complete integration testing and initial flight hardware will be delivered. Explosive test design and fabrication for the basing facilities will be initiated. Testing at the Engineering Test Bed will be continued to evaluate mechanical & transportation and handling concepts, command and control, power systems, physical security, preservation of location uncertainty, Strategic Arms Limitations Treaty verification, and other elements related to selected Multiple Protective Shelter basing concepts. A cost analysis was performed in September 1980 to validate the funding necessary to fulfill the FY 1982 requirements.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	670,000	1,551,000	2,179,600	5,139,500	9,690,100	

(U) OTHER APPROPRIATION FUNDS: (\$ in thousands)

Program Element 11215F (M-X Squadrons)

Military Construction	62,400	17,100	366,000	1,788,100	15,742,300	17,975,900
Aircraft Procurement	-	3,386	-	76,500	514,700	591,200
Missile Procurement	-	-	-	1,776,200	23,923,300	25,699,500
Operations & Maintenance	Not Applicable					

* Reflects reprogramming action of +\$130 thousand subsequent to 30 Sep 1980.

Program Element: #64312F

Title: M-X

DoD Mission Area: Land-Based Strike, #111

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The President directed full-scale engineering development of the M-X missile and horizontal shelter basing mode in September, 1979. The objective of this program is to develop an advanced, Multiple Independently Targetable Reentry Vehicle Intercontinental Ballistic Missile (ICBM), M-X, for deployment in a Multiple Protective Shelter survivable basing mode in the mid-1980s. The major areas of effort are development of missile and basing subsystems, system integration and extensive system/subsystem testing to support the production/development decision. The missile subsystems are and will continue to be operational designs of the preprototype hardware developed in the Advanced ICBM Technology Program (Program Element 63305F). The missile subsystems will include an advanced guidance set derived from the Advanced Inertial Reference Sphere prototype. This prototype is an all-attitude guidance system designed for the transportable environment. The three booster stages will contain an advanced solid propellant and lightweight motor cases and advanced nozzles which will produce about twice the propulsion efficiency of current ICBM systems. The M-X Post Boost Vehicle, although significantly larger than that of Minuteman, will use a similar, well proven configuration. The M-X reentry vehicle will be the Mark 12A. The development of survivable basing mode elements will continue and include ground power systems; physical security hardware procedures; preservation of location uncertainty concept development; command control and communication systems development; and continued operational vehicle design and fabrication. In addition, design of deployment area roads and structures, and techniques for their construction will continue. The Renewable Energy Systems program will develop and demonstrate reliable, cost effective alternative energy sources (using wind, solar, geothermal and waste-to-energy technology) for providing thermal and electrical power to M-X support facilities in the deployment area.

The requirement for M-X is a function of the need to respond to current and projected Soviet advanced ICBM developments. This will require a high degree of survivability. Further, the current ICBM systems are somewhat deficient in the measures of flexibility which will be required in the 1980s to maintain a high level of deterrence across the entire spectrum of potential response. The pace and scope of Soviet ICBM developments will result in a destabilizing imbalance between US and Soviet strategic capability in the mid-1980s. M-X deployment is needed to alleviate this predicted asymmetry.

(U) RELATED ACTIVITIES: This program is directly related to the results of efforts in the Advanced ICBM Technology Program (PE 63305F), M-X Squadrons (PE 11215F), and ABRES (PE 63311F). This program and the related programs are all managed within the Ballistic Missile Office, and thus close coordination is assured. PE 11215F contains the funding for both M-X military construction and missile/aircraft procurement.

(U) WORK PERFORMED BY: The program is managed by the Ballistic Missile Office, Norton Air Force Base, CA. Testing facilities at Arnold Engineering Development Center, Tullahoma, TN, will be used for motor testing. Contractors include: Thiokol, Brigham City, UT; Aerojet General, Sacramento, CA; Hercules, Magna, UT; Rocketdyne, Canoga Park, CA; Autonetics, Anaheim, CA; Northrop, Hawthorne, CA, and Norwood, MA; Honeywell, St Petersburg, FL; Charles Stark Draper Lab, Cambridge, MA; Logicon, Torrance, CA; Westinghouse, Sunnyvale, CA; AVCO, Lowell, MA; Martin Marietta, Denver, CO; TRW, Ballistic Missile Division, Norton AFB, CA; Boeing, Seattle, WA; GTE Sylvania, Needham, MA; and General Electric, Philadelphia, PA.

Program Element: #64312F

DoD Mission Area: Land-Based Strike, #111

Title: M-X

Budget Activity: Strategic Programs, #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Full-scale development of the M-X missile in the horizontal multiple protective shelter basing mode was initiated in September 1979. Funds requested in the FY 1979 Supplemental were used to accelerate purchase of tooling and missile subsystems for the M-X flight test program. In addition, system definition of multiple protective shelter basing was accelerated, to include acceleration of the construction of an engineering test bed. This test bed is being used to investigate engineering solutions to problems associated with multiple protective shelter basing such as preservation of missile location uncertainty, Strategic Arms Limitation Treaty verification, basing hardware to include physical security sensors, and vehicle roadability testing.

Fabrication and ground testing was initiated on all the major missile and selected multiple protective shelter basing systems previously developed under Program Element 63305F (Advanced ICM Technology). This included the three booster motors (stages I, II, and III), the post-boost vehicle, and guidance and control missile subsystems. The basing-unique vehicle subsystems began initial testing to validate the multiple protective shelter basing concept in such a manner that there was no commitment to one basing mode as directed by Congress. The hardware for the security and command and control began initial fabrication. Flight and targeting software design was continued. Extensive flight and ground test planning and special test-unique hardware design was also continued. Major subscale and full scale high explosive test design and fabrication for the basing facilities was initiated. Testing at the Engineering Test Bed was continued to evaluate various elements (power, security, preservation of location uncertainty, transportation/handling, command and control) associated with basing concepts. Finally, the missile and multiple protective shelter basing design was reviewed as an integrated system to establish the functional configuration baseline, review allocated requirements, approve operational and maintenance concepts, and ultimately approve the overall system design requirements.

2. (U) FY 1981 Program: A design of the operational assembly area facilities and roads and utilities will begin in the deployment area. Most of the FY 1981 RDT&E request continues to be for missile development to include: propulsion stages; reentry system; guidance and control hardware and software; missile handling and transportation equipment; instrumentation and flight safety system; training equipment; data collection and evaluation; and general engineering support. The basing development includes design, fabrication and test of: transporter-launcher vehicles; command, control and communications systems; ground power; physical security hardware and software; countermeasure techniques and equipment; environmental systems; targeting software, shelter closure development; facilities development; and environmental assessment. In addition, nuclear hardness and survivability testing will be conducted, as well as basing tests and flight test preparation. Full scale development efforts will continue on missile and basing subsystems, to include continued and refined design, fabrication and testing of the M-X missile in an multiple protective shelter basing mode. Activities are planned to develop preliminary assessments of renewable energy systems availability in the deployment area; develop preliminary designs of renewable energy systems and assess their technical feasibility; and develop preliminary integrated system configurations for M-X application.

Program Element: #64312F

DoD Mission Area: Land-Based Strike, #111

Title: M-X

Budget Activity: Strategic Programs, #3

3. (U) FY 1982 Planned Program: Weapon system full scale development will continue. Although the significant construction effort will be at Vandenberg AFB and the Operational Base Test Site for roads, utilities, and facilities, construction will begin on the operational designated assembly area. The designated assembly area missile assembly, munitions, and operations and maintenance facility design along with design work on the designated deployment area cluster maintenance facility and area support center will culminate in an initial base critical design review. The training equipment and course work will be developed for use by Strategic Air Command and Air Training Command personnel to train the operational and maintenance users. The test equipment for the operational base test site will also be designed and fabricated. Design and fabrication of the missile and its launch canister will proceed through integration testing. First flight hardware will be delivered and there will be flight proof testing of the instrumentation flight safety system. The Vandenberg AFB flight test pads will go through assembly and check out. The launcher will undergo preliminary design and the shelter closure will conclude its critical design effort and initiate fabrication. The countermeasure equipment will also proceed through its critical design phase and begin testing activities. Complete system integration testing will begin at Vandenberg AFB. The Airborne Launch Control Center will become available to support flight testing. Thrust vector control and stage destruct testing will be accomplished at Arnold Engineering Development Center. The cost difference in 1982 was caused by the basing mode refinements directed by SecDef in the Spring of 1980, and adding the Renewable Energy Sources program and integrated fuze development into the M-X program.
4. (U) FY 1983 Planned Program: Weapon system full scale development will continue. There will be a critical design review on each of the missile's four stages leading to a first flight in January 1983. Flight hardware for the guidance and control system will be delivered. The inertial measurement unit will complete its critical design phase and the entire reentry system will go through integration and testing. There are five test flights scheduled from Vandenberg AFB and Defense System Acquisition Review Council III is scheduled for mid CY 1983. The Vandenberg AFB support equipment delivery will be completed along with assembly and checkout of the second Vandenberg AFB shelter. Training equipment will be fabricated and production of the countermeasure equipment will begin. Operational base assembly and checkout will be initiated by construction of the designated assembly area missile assembly, munitions, and operations and maintenance areas. The launcher will complete its critical design phase as will the command, control and communications equipment. Missile ejection hardware will be tested at the Department of Energy test site. Also lightning effects and electromagnetic pulse effects will be studied and tested.
5. (U) Program to Completion: M-X system development will continue with the emphasis shifting to flight testing and baselining the final M-X system design. The system Initial Operational Capability is July 1986 and the Research, Development, Test and Evaluation projection shows that FY 1987 will be the last year requiring Research and Development funds. The main operating base construction begins in 1983 and shelter construction is initiated in 1984. Construction will continue through FY 1989 at which time the system will achieve full operational capability.

Program Element: #64312F

DoD Mission Area: Land-Based Strike, #111

Title: M-X

Budget Activity: Strategic Programs, #3

6. (U) Milestones:

	<u>Date</u>
Defense System Acquisition Review Council I	9 March 1976
Validation Phase Initiated	1 October 1976
Defense System Acquisition Review Council IIa	5 December 1978
Defense System Acquisition Review Council IIb	31 March 1979
Defense System Acquisition Review Council IIc	14 July 1979
Defense System Acquisition Review Council IId	21 July 1979
Full Scale Development Initiated	September 1979
System Design Review	23 September 1980
Draft Environmental Impact Statement	18 December 1980
Final Environmental Impact Statement	July 1981
Operational Base Construction Start	January 1982
First Flight Test	January 1983
Defense System Acquisition Review Council III	Mid CY 1983
Initial Operational Capability (10 missiles)	Mid CY 1986
Final Operational Capability (200 missiles)	End CY 1989

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1981 budget data: The cost differences were caused by the basing mode refinements directed by SecDef in the Spring of 1980, and adding the Renewable Energy Sources program and integrated fuze development into the M-X program.

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

1. (U) Test and Evaluation Data: The requirement for an advanced Intercontinental Ballistic Missile system now designated M-X, was defined in Strategic Air Command Required Operational Capability 16-71. In 1973, the Air Force Chief of Staff directed an advanced missile technology effort. The program proceeded through the conceptual and validation phases and in December 1978 completed a successful Defense Systems Acquisition Review Council milestone. The President authorized entry into the Full Scale Engineering Development phase in September 1979. Since 1973, several basing modes have been studied, including vertical silos, horizontal shelters, trenches, sub-merged pool, and an air mobile option. This effort culminated in the Presidential direction in 1979 to proceed with the Horizontal Shelter/Transporter and Mobile Launcher System which is designed to meet Strategic Arms Limitations constraints and maintain Preservation of Location Uncertainty. Mission requirements for the missile have remained essentially constant with the exception of the throwweight limitation. Development Test and Evaluation began during the advanced development program and continued through the validation phase to investigate survivability, performance, and costs of critical elements of the missile and horizontal shelter and buried trench basing modes. The data from these efforts supported the Defense System Acquisition Review Council II reviews.

(U) Pre-Full Scale Engineering Development tests were conducted to establish confidence in a decision to enter Full Scale Engineering Development. The test data provided high confidence that the required weapon system performance could be met within the identified state-of-the-art technologies at a reasonable cost. Additionally this testing provided hardware design data which will assure more comprehensive specification and has allowed a more realistic estimate of life cycle system costs. Specifically, the Advanced Development Phase test program evaluated critical questions and areas of risk including guidance testing; propulsion performance; radiation characteristics; motor and nozzle performance; reentry system testing; launcher and shelter performance; command, control, and communications testing; ground power studies; physical security system testing; and nuclear hardness and survivability testing. This testing was done at contractor test facilities, Arnold Engineering and Development Center at Tullahoma, Tennessee, and Rocket Propulsion Lab at Edwards Air Force Base, California.

(U) Pre-Full Scale Engineering Development testing has demonstrated the following technologies. The third generation gyro, specific force integrating receiver, and advanced inertial reference sphere of the guidance and control system will enable the M-X to achieve better accuracy than the Minuteman III. Production capability of these units was demonstrated by producing thirty specific force integrating receivers, twenty-four third generation gyros, and three advanced inertial reference spheres. Laboratory testing of the guidance and control components have accumulated 31,000 hours on four inertial measurement units of which 14,000 hours are on one unit. Two hundred thirty thousand test hours have been accumulated on the third generation gyro and specific force integrating receiver, and an additional 425,000 hours of life test have been accumulated on the third generation gyro bearing. These data support the decision to proceed with the inertial measurement unit and instruments for Full Scale Development. Half-scale and full-scale upper stage motors were tested including high-expansion-ratio extendable nozzle exit cones; high-strength, lightweight Kevlar motor cases; high performance Class I Division I propellants; a warm gas control actuator; and composite shim flexseal movable nozzle joints and carbon/carbon nozzle materials. Two full-scale lower stage nozzles were tested following materials evaluations and bench tests. These tests demonstrated that carbon/carbon nozzle material and the Techroll movable nozzle joint are capable of high angle, high rate,

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

omnial deflection. Tests were conducted on a low length-to-diameter ratio motor typical of M-X third stage requirements to demonstrate the thrust termination capability. Static firing tests of two short-duration motors demonstrated the feasibility of deploying a full scale folding petal extendable nozzle exit cone over the plume of an M-X motor, and the ability to design an extendable nozzle exit cone to minimize the potential damage from particle impingement in high expansion ratio exit cones. M-X performance can be achieved at low risk within demonstrated state-of-the-art even though in-flight environments have not yet been measured. Carbon/carbon integral throat/entrance components have been manufactured for Stages I, II, and III. Carbon/carbon fixed nozzle liners (used only on Stage III) have been manufactured. Simulated missiles were ejected from a canister during six tests using a gas generator eject system. The launch dynamics and gas dynamics have been characterized sufficiently for continuing with this design concept. Horizontal shelter door stress test results provided data for cost trades of protect shelter design. The vertical shelter engineering test bed program at Mercury, Nevada, provided data on shelter door and road construction and mechanical and transporter systems performance. Nuclear radiation simulation tests have been conducted on advanced technology semiconductors. Electron beam and underground nuclear tests were conducted on propellant samples. Laboratory and underground nuclear tests were conducted on extendable nozzle exit cone materials. The X-ray shielding capability of high-Z external protection materials was evaluated. Pebble impact and dust erosion tests were conducted on candidate external protection materials and candidate reentry system shroud materials.

Material response to nuclear simulated environments is well enough understood to enter full scale engineering development. High-energy-density power cell components have been tested to establish extended survival power. The design data gathered from this test validates the ground power extendable survival concept. Preservation of Location Uncertainty testing has been conducted at Vandenberg Air Force Base, the Nevada Test Site, and the Naval Surface Weapon Center. These tests have looked at thermal, acoustic, seismic, tilt and magnetic signatures of representative equipment, and the data collected were used to verify sensor performance and signature prediction models. Command, Control and Communications testing confirmed the feasibility of simulcast transmission and furnished data on propagation path loss and atmospheric noise from several prospective M-X deployment areas. Scale model and full-scale antenna tests have demonstrated that a buried medium frequency dipole equals the performance of a short vertical dipole in the air. Wide area surveillance tests demonstrated the capability for detection and tracking up to ten kilometers and discrimination of humans up to five and a half kilometers, and, with optical augmentation, human discrimination ranges up to ten kilometers. Parametric data gained from this testing will lead to requirements definition of false alarm rates, detection sensitivity, and target discrimination. Results of M-X supersonic wind tunnel tests at Arnold Engineering Development Center showed that the center of pressure was slightly forward of the predictions, the raceway induced rolling moment was greater than predicted, and the jet-on base drag was greater than predicted. The operation of the roll control system showed no significant effect on the overall missile aerodynamic characteristics, but did indicate localized heating effects.

(U) The M-X Test and Evaluation program is a combined Development Test and Evaluation/Operational Test and Evaluation test program. The combined program was developed to conserve test assets in both ground and flight testing. The combined test program prior to production is structured to address three major areas: demonstrate system and subsystem specification compliance, validate performance goals, and resolve areas of risk defined in the Test and Evaluation Master Plan. The subsystem test and evaluation will be conducted at Vandenberg Air Force Base for the 20-missile flight test program and limited basing evaluation, at the Operational Base Test Site near the operational base for detailed basing system evaluation, and at the operational base for total weapon system demonstration.

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

(U) M-X Developmental Test and Evaluation will be conducted during Full-Scale Engineering Development to assist the engineering design and development process, to verify accomplishment of specification requirements, and to address and resolve development test and evaluation areas of risk. The goal of Development Test and Evaluation will be to verify that the M-X missile and horizontal shelter deployment facilities and equipment have been designed to satisfy operational requirements, and that each of the Development Test and Evaluation areas of risk has been resolved to a degree sufficient to permit a production decision to be made at Defense System Acquisition Review Council III. Twenty test flights from the Western Test Range at Vandenberg Air Force Base, California have been scheduled at approximately 60 day intervals beginning in January 1983. The above Development Test and Evaluation goals will be achieved by accomplishing the following Primary Development Test and Evaluation objectives: evaluate the capability of the M-X stage II and III motor extendable nozzle exit cones to survive and perform in actual powered flight; evaluate the capability of the Advanced Inertial Reference Sphere Guidance and Control units to achieve accuracy, reliability, and survivability goals in flight; determine M-X weapon system hardness and survivability; determine effectiveness of procedures to insure the preservation of location uncertainty; evaluate the capability of the command, control, and communication system in various environments; confirm the capability of each configuration item to meet the specified design required to evaluate total M-X weapon system performance in the pre-, trans-, and post-attack mode; evaluate missile flight performance and reliability to include launcher, stages, guidance and control accuracy and reentry system footprint, and time of flight performance capabilities; demonstrate the capability of the instrumentation and flight safety system and its suitability for entering Operational Test and Evaluation and demonstrate the overall M-X weapon system readiness to enter Operational Test and Evaluation.

2. (U) Operational Test and Evaluation: Demonstration and Validation Phase. Several tests conducted by the Ballistic Missile Office during this phase have been judged to be operationally representative. Elements of these tests will be included in the Air Force Test and Evaluation Center's evaluation of system survivability, operational effectiveness, and operational suitability. The most important of these are summarized as follows: (a) Preservation of Location Uncertainty. The Air Force Test and Evaluation Center designed a series of tests, which were conducted in conjunction with the Ballistic Missile Office, on a one million pound vehicle at the Nevada Engineering Test Bed. The tests employed a large variety of existing sensors to characterize possible operational signatures. Results of these tests are being analyzed. (b) Physical Security System. An M-X Security System Critical Components Test Program was conducted in representative terrain and climate conditions at Yuma and at the Nevada Engineering Test Bed. The capability of radar, electro-optical systems, seismic, and acoustic vibration sensors to detect intruders under various environmental conditions and to filter out nuisance alarms has been evaluated. Preliminary test results suggest that wide area surveillance backed by point security sensors will be feasible. (c) Command, Control and Communications. A medium frequency radio network will be used for post-attack communications within the M-X deployment area for transmitting status and control between the deployment area and surviving elements of the Worldwide Military Command and Control System. A small medium frequency network consisting of eight transmitters located in mobile vans was tested at the Nevada Engineering Test Bed to validate the communications concept. Preliminary results indicate that the medium frequency radio simulcast network was successful in transmitting and receiving data between valleys and mountain ranges and the bit error rates were within required performance parameters.

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Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

(U) In mid 1980 initial testing on a large M-X transporter type vehicle was completed at the engineering test bed. The Air Force Test and Evaluation Center assisted the Ballistic Missile Office by providing representative Strategic Air Command maintenance personnel to operate, maneuver, and perform minor routine maintenance on the large vehicle. In addition to the testing described above, the Strategic Air Command is currently conducting Operational Test and Evaluation of the MK12A reentry vehicle on the Western Test Range using operational Minuteman missiles. The MK12A has been selected as the M-X deployment baseline reentry vehicle. Applicable data from this testing will be included in the Air Force Test and Evaluation Center evaluation of operational effectiveness.

(U) Full Scale Engineering Development. Test and evaluation conducted during this phase will be combined Development Test and Evaluation/Initial Operational Test and Evaluation with separate additional Initial Operational Test and Evaluation events. Operational Test and Evaluation objectives have been integrated into both the Development Test and Evaluation ground and flight test programs. A total of twenty flight tests are planned to support missile system development and performance evaluations. These flight tests will begin during Development Test and Evaluation/Initial Operational Test and Evaluation and continue through Defense System Acquisition Review Council III and Follow-on Test and Evaluation. The flight test articles will be configured with test reentry vehicles and an in-flight safety system. The flight test series will begin in 1983. For approximately the first three years, Air Force Test and Evaluation Center test involvement will focus on subsystem testing at Air Force and contractor test facilities. At least six months before the first flight test (second quarter 1983) Air Force Test and Evaluation Center personnel will move to Vandenberg Air Force Base, California. Emphasis will then be placed on system testing -- in particular, testing from the mobile ground system test facilities. The operational suitability evaluation will include availability, reliability, maintainability, logistics supportability, operations and support costs, human factors, and training. This period of testing will be at least long enough to accomplish all operational tasks defined by the system's user, Strategic Air Command. Air Force Test and Evaluation Center will maintain overall management responsibility for M-X Initial Operational Test and Evaluation through Defense System Acquisition Review Council III review. Air Force Test and Evaluation Center will also retain management responsibility for Follow-on Test and Evaluation prior to initial operational capability at which time responsibility will transfer to Strategic Air Command. Strategic Air Command will operate and maintain the system. Operational Test and Evaluation testing will be conducted at Vandenberg Air Force Base, Southwest United States locations, and contractor facilities.

Budget Activity: Strategic Programs, #3

Program Element: #64312 M-X

3. (U) Systems Characteristics:

(U) Characteristics:

(U) Length:
(U) Diameter:
(U) Weight:
(U) Throwweight:
(U) Payload:

Accuracy:

Range:

Hardness of Protective

Shelters:

Preservation of Location

Uncertainty:

Launch and Flight Reliability:

Pre-attack Availability:

Reaction Time:

Objective:

71 feet
92 inches
190,000 pounds
7937 pounds
10 reentry vehicles
(constrained by SALT II)

Demonstrated:

To Be Determined

"
"
"
"

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64361F

DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	90,627	107,300	70,600	11,300		1,098,700

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Launched Cruise Missile is a small, long range, accurate, nuclear armed air-to-ground cruise missile programmed for use on the B-52 force. The Air Launched Cruise Missile greatly enhances the air breathing leg of the TRIAD by: stressing and diluting Soviet defenses, thus improving the overall penetration prospects of the mixed air breathing force; compelling the Soviets to devote substantial resources to their national air defenses to counter this threat; increasing the number of weapons in our strategic forces in the near term; convincing the Soviets that their massive air defense efforts will not substantially blunt United States air breathing strike capabilities; and providing the Soviets an incentive to agree in future Strategic Arms Limitation Treaty negotiations to further force reductions and perhaps to air defense limitations as well.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Approximately one-third of these funds will be used to complete the B-52G Offensive Avionics System/Air Launched Cruise Missile integration with the last five Air Launched Cruise Missile launches from the modified B-52G. It will also continue the development of support equipment necessary to meet the December 1982 Initial Operational Capability at Griffiss Air Force Base, NY. The request is based on an independent cost analysis estimate conducted prior to and approved by the 30 April 1980 Defense System Acquisition Council III.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	90,000	108,400	32,800			1,050,100
Missile Procurement	371,200	571,100	517,000		2,296,400	3,954,600

OTHER APPROPRIATION FUNDS:

Missile Procurement (Quantity)	372,280 (225)	579,600 (480)	605,400 (440)	611,700 (440)	2,294,900 (1785)	4,662,700 (3418)
Military Construction		66,300	108,000	36,900	72,700	298,100
Department of Energy Costs (W-80 Warhead)						

Program Element: #64361F

DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile

Budget Activity: Strategic Programs #3

DETAILED BACKGROUND AND DESCRIPTION: The initial Air Launched Cruise Missile was the Boeing AGM-86A developed from the cancelled Subsonic Cruise Armed Decoy program. The AGM-86A had a parallel advanced development with the General Dynamics Sea Launched Cruise Missile. The Sea Launched Cruise Missile, built for torpedo tube or ship deck launch, was designed as both a land attack and an anti-ship missile. The Air Launched Cruise Missile and the Land Attack Sea Launched Cruise Missile shared a common engine (Williams F-107 turbofan); warhead (W-80 and navigation/guidance subsystems (Litton LN-35 Inertial Navigation Element with Terrain Contour Matching updates integrated by McDonnell-Douglas Astronautics). Both the Air Launched Cruise Missile and the Sea Launched Cruise Missile were approved for Full Scale Engineering Development in January 1977. The Air Force was directed to give priority to the development of the long range AGM-86B. A Joint Cruise Missiles Project Office was established, under Navy management, to ensure maximum commonality subsystems to and accomplish joint test and evaluation. An Air Launched Cruise Missile system competition was conducted between the Boeing AGM-86B and the General Dynamics AGM-109 to provide a more cost effective missile system. The Boeing missile was selected in March 1980 due to its superior terrain following performance, navigation accuracy and maintainability characteristics. The Secretary of Defense approved full production of the Air Launched Cruise Missile at the 30 April 1980 Defense System Acquisition Review Council III meeting. Following that decision, the Boeing Company was awarded a fiscal year 1980 contract for 225 missiles with an option for 480 more in fiscal year 1981. The Air Launched Cruise Missile provides the B-52G force with a 2500 kilometers (system operational range) air-to-ground missile which can be launched from both inside and outside enemy defenses. Current plans call for the procurement of 3418 Air Launched Cruise Missiles to equip each of the 151 Primary Aircraft Authorization B-52Gs with 20 Air Launched Cruise Missiles. Initially, 12 Air Launched Cruise Missiles will be loaded externally on each B-52G. In the mid-1980s, eight more Air Launched Cruise Missiles, loaded internally on a rotary launcher, will replace the current load of gravity bombs and Short Range Attack Missiles. By 1990, all B-52Gs could be equipped with 20 Air Launched Cruise Missiles each. The threat to the cruise missile will include radar surveillance, surface-to-air missiles, fighter interceptors and electronic warfare systems. This threat is currently limited in capability against the Air Launched Cruise Missile. The development of new Soviet threat systems and improvement of existing systems could result in an increase in threat effectiveness in the outyears.

(U) RELATED ACTIVITIES: The AGM-86B Air Launched Cruise Missile, land attack Sea Launched Cruise Missile, and the Ground Launched Cruise Missile programs are structured to have maximum commonality in engine and navigation/guidance subsystems. The Air Launched Cruise Missile and Sea Launched Cruise Missile share the common W-80 nuclear warhead under development by the Department of Energy. The Sea Launched Cruise Missile and Ground Launched Cruise Missile, the engine, navigation/guidance and mission planning projects are jointly managed through the Joint Cruise Missiles Project Office. However, after the April 1980 production decision, management of the Air Launched Cruise Missile was transferred to the Air Force Strategic Systems Program Office. The B-52 Squadrons, Program Element 11113F, is also related to the Air Launched Cruise Missile. The B-52 Cruise Missile Carriage, Offensive Avionics System, and other projects require close coordination with the Air Launched Cruise Missile program to ensure full compatibility. A memorandum of understanding exists between the Air Force Strategic Systems Program Office and the Joint Cruise Missile Project Office which delineates interface tasks.

(U) WORK PERFORMED BY: The Strategic Systems Program Office works under the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH in cooperation with the Joint Cruise Missiles Project Manager (Naval Material Command), Washington, DC. The Air Launched Cruise Missile program also interfaces with; Department of Energy, Washington, DC

Program Element: #64361P

DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile

Budget Activity: Strategic Programs #3

(W-80 warhead); and Defense Mapping Agency, Washington, DC and St. Louis, MO, Strategic Air Command and Joint Strategic Target Planning Staff, Offutt AFB, NE (terrain contour matching map and mission planning). Department of Defense in-house facilities include: Arnold Engineering Development Center, TN; Naval Ship Research and Development Center, Bethesda, MD; Naval Air Propulsion Center, Trenton, NJ; Radar Target Scatter Facility and White Sands Missile Range, Holloman AFB, NM; Air Force Weapons Laboratory and Air Force Test and Evaluation Center, Kirtland AFB, NM; 4950th Test Wing and the Flight Dynamics Laboratory, Wright-Patterson AFB, OH; 6514th Test Squadron, Hill AFB, UT; Air Force Flight Test Center, Edwards AFB, CA and the Pacific Missile Test Center, Point Mugu, CA. The major contractors are: air vehicle - Boeing Aerospace, Seattle, WA; carrier aircraft equipment/cruise missile integration - Boeing Military Aircraft Company, Wichita, KS; engine - Williams Research Corporation, Walling Lake, MI and Teledyne CAE, Toledo, OH; navigation guidance - McDonnell Douglas Astronautics St. Louis, MO, Litton Industries, Woodland Hills, CA, Litton Canada Limited, Toronto, ONT, Minneapolis Honeywell, Minneapolis, MN; recovery system - Pioneer Parachute Company, Manchester, CT and Irvine Company, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Boeing AGM-86A utilized the technology of the cancelled Subsonic Cruise Armed Decoy air vehicle and engine to produce prototype models for testing. The Milestone II review in January 1977 approved the Full Scale Engineering Development for the current cruise missile programs. A Strategic Systems Program Office was formed at Wright-Patterson Air Force Base to integrate the Air Launched Cruise Missile into the B-52. The program included Air Launched Cruise Missile design and fabrication, B-52 integration, and rotary launcher and pylon development. In June 1978, Under Secretary of Defense for Research and Engineering deleted the Limited Operational Capability (June 1980) and redefined the Initial Operational Capability as one squadron of B-52G equipped with 12 Air Launched Cruise Missiles each in December 1982. Boeing Military Aircraft initiated modification of three test B-52 aircraft in support of the competitive flyoff. Williams Research F-107 engine qualification tests were initiated. Teledyne CAE was selected as licensed second source for the F-107 engine. Both Air Launched Cruise Missile contractors initiated the pilot production of 12 missiles each in September 1978. The major fiscal year 1979 effort was the initiation of a two year competitive flyoff from February 1978 through March 1980. Each contractor participated in ten flights each, twelve were successful, six partially successful and two unsuccessful. The big event in fiscal year 1980 was source selection and the Air Launched Cruise Missile production decision. The AGM-86B began a 19 flight Follow-on Operational Test and Evaluation program in June 1980 to estimate the operational effectiveness and suitability of the Air Launched Cruise Missile system. Other development activities included formal qualification of the navigation/guidance system, completion of the engine qualification test, development of a new radar altimeter, maintainability demonstrations, flutter and missile jettison tests, pylon and rotary launcher tests and support equipment development. The Mission Planning Data Preparation system was delivered to the Strategic Air Command. The development effort also supported the Air Launched Cruise Missile/Offensive Avionics System interfaces.

2. FY 1981 Program: All fiscal year 1981 activity is centered around meeting the September 1981 First Alert Capability at Griffiss Air Force Base, NY (one B-52G modified with Offensive Avionics System equipped with 12 external Air Launched Cruise Missiles). The Air Launched Cruise Missile Follow-on Operational Test and Evaluation program completes the last launches from the cruise missile integrated B-52G and begins test flights with the first modified Offensive Avionics System B-52G aircraft.

Development of the missile radar altimeter test assembly

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Program Element: #64361F

DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

will be completed. Rotary launcher definition will be completed and Offensive Avionics System interface activity will identify engineering changes required. Second sources will be qualified for the engine and navigation/guidance equipment. Software activity will continue for the electronic systems test set test package requirements. Organizational and intermediate level technical orders will be verified. Development of depot level support equipment will begin. Engineering changes resulting from the Follow-on Operational Test and Evaluation program will be documented and incorporated into the production design. Retrofit kits will be developed to update missiles in the operational inventory to the approved configuration. The Air Launched Cruise Missile site activation task force will be active at Griffiss Air Force Base, NY. Site activation will also initiate interim contractor support to assist in maintaining initial operational readiness of the Air Launched Cruise Missile system.

3. (U) FY 1982 Planned Program: The Air Launched Cruise Missile Initial Operational Capability (first Offensive Avionics System modified B-52G squadron with 12 external Air Launched Cruise Missiles) will occur in December 1982 at Griffiss Air Force Base, NY. All activity in fiscal year 1982 will be prioritized to meet this critical program milestone. Flight test activities will include support for five launches from the Offensive Avionics System configured B-52 which are scheduled to verify the performance of software changes to be incorporated in the Initial Operational Capability configuration.

4. (U) FY 1983 Planned Program: Planned activity is the completion of depot level support equipment development. Any additional effort will depend on the success of the Air Launched Cruise Missile/B-52G Offensive Avionics Systems integration.

5. (U) Program to Completion: There is no development activity planned beyond fiscal year 1983. The cost increase (\$37.8 million in fiscal year 1982 and \$11.3 million in fiscal year 1983) is related to cost increases and subsequent deferral of tasks to fiscal years 1982 and 1983. The major causes are inflation, a delay in completion of the competitive program, expansion of the Follow-on Operational Test and Evaluation program from 11 to 19 flights, deferral of the support equipment development, cost increases in airframe, engine and navigation/guidance development, and the costs associated with development of previously undefined depot level support equipment.

6. (U) Milestones:

- A. Defense System Acquisition Review Council I (Program Initiated)/(AGM-86A)
- B. Defense System Acquisition Review Council II (AGM-86A)
- C. Defense System Acquisition IA (AGM-86A)
- D. Jettison Tests Completed (AGM-86A)
- E. Engine Preliminary Flight Rating Test Complete
- F. Initial Department of Energy Phase III (Warhead)
- G. First Powered Flight (AGM-86A)
- H. First Guided Flight (AGM-86A)
- I. Defense System Acquisition Review Council II (AGM-86A/B)
- J. AGM-86B/AGM-109 Competition Directed
- K. System Design Reviews

Dates

February 1974
December 1974
March 1975
June 1975
October 1975
February 1976
March 1976
September 1976
January 1977
July 1977
May 1978

Program Element: #64361F

DOD Mission Area: Airborne Strike, #113

Title: Air Launched Cruise Missile
Budget Activity: Strategic Programs #3

L. First Full Scale Engineering Flight

M. Source Selection

N. Defense System Acquisition Review Council III (Production Decision)

O. Follow-on Operational Test and Evaluation

P. First Alert Capability (One B-52G)

Q. Initial Operational Capability (First B-52G Squadron)

July 1979

March 80

April 1980

June 1980 - December 1981

September 1981

December 1982

Budget Activity: Strategic Programs #3
Program Element: #6436F, Air Launched Cruise Missile

Test and Evaluation Data

1. (U) Development Test and Evaluation: During the period fiscal year 1975 through the first quarter fiscal year 1977, six advanced development tests were conducted on the medium range Boeing AGM-86A Air Launched Cruise Missile. Jettison tests were successful, demonstrating that the AGM-86A could be safely launched at low and high airspeeds, and four of the six flight tests were successful. The fifth flight went out of control due to a guidance system malfunction and the sixth flight failed to obtain an engine start.

(U) The General Dynamics AGM-109 Air Launched Cruise Missile inherited the Development Test and Evaluation base of the AGM-109 Sea Launched Cruise Missile. The Sea Launched Cruise Missile has had a total of 49 flight tests as of 31 January 1980. The Joint Cruise Missiles Project Office's records indicate that 41 were successful while eight were failures. Previously identified problems have been resolved and reported by the Sea Launched Cruise Missile program.

(U) The Full Scale Engineering Development program for the long range Air Launched Cruise Missile is structured into two phases. The first phase was the competitive flyoff between the AGM-86B and the AGM-109 with the AGM-86B chosen to proceed into production. The second phase consists of 19 follow-on flights to support B-52G/Air Launched Cruise Missile integration. The Full Scale Engineering Development test program began in April 1979 with B-52 delivered to Edwards Air Force Base, CA in May 1979 to begin the missile competitive flight test program. A third B-52 was used at Edwards Air Force Base for performance, flutter and jettison tests. The competitive flight test program ran from July 1979 through 8 February 1980 and consisted of B-52 performance evaluations with Air Launched Cruise Missiles loaded; captive carry tests as required; live launches (ten flights per contractor); reliability and maintainability demonstrations; mid-air recovery; and survivability and vulnerability testing. The ten flights per competitor were further divided into three Development Test and Evaluation flights conducted by the contractors and seven Development Test and Evaluation/Initial Operational Test and Evaluation flights conducted by the contractors Force Development Test and Evaluation/Initial Operational Test and Evaluation flights conducted by a joint Air Force Development Test and Evaluation team. Initial Operational Test and Evaluation was managed by the Air Force Test and Evaluation Center. Of the twenty flights, twelve were successful, two unsuccessful and six partially successful. There were no significant problems with either of the missiles or the B-52 flutter and jettison tests.

(U) The Boeing AGM-86B was selected on 25 March 1980. The AGM-86B missile is now participating in an additional 19 flight Follow-on Operational Test and Evaluation program that started in June 1980 with completion in December 1981 utilizing the Cruise Missile Integration B-52G (12 flights) and seven integration flights from the Offensive Avionics System configured B-52G test aircraft during the March-December 1981 time frame. The follow-on testing will use 11 missiles from the fiscal year 1978/1979 missile buys and 8 refurbished missiles. Six of the 19 scheduled flights have been accomplished with four successes and two failures. The first failure was caused by an engine problem (burn-through of the first stage turbine). Necessary hardware modifications to cure this problem have been identified and implemented. The second unsuccessful mission ended in a crash because the missile wings and tail surfaces did not deploy. The cause of the failure is now under investigation.

Budget Activity: Strategic Programs #3

Program Element: #64361P, Air Launched Cruise Missile

(U) Wind tunnel testing was accomplished at Arnold Engineering Development Center and the Naval Ship Research Development Center. Engine flight qualification and calibration occurred in fiscal year 1979 and fiscal year 1980 at the Arnold Engineering Development Center and the Naval Air Propulsion Center. Rotary launchers were proof qualification tested in fiscal year 1979. Pylon proof testing began in February 1979. Pylon Jettison began in August 1980.

(U) The missiles tested during the flyoff were representative of those that are in production. Changes identified during the flyoff will be tested by Boeing during the 19 flight follow-on phase. Included is a new radar altimeter and the production configured engine. Support equipment, missile handling equipment and full capability electronic systems test sets are being tested during the follow-on test period.

(U) The Air Launched Cruise Missile competition involved Boeing Aerospace, Seattle, WA, and General Dynamics Convair, San Diego, CA for the missile air vehicle and Williams Research, Wall Lake, MI is the prime contractor for the engine. Teledyne CAE, Toledo, OH, will be the second source for the engine. Teledyne will start qualification testing of its copy of the engine in late 1981. McDonnell Douglas, St Louis, MO provided navigation/guidance hardware to both missile contractors, but participated in the competition with Boeing by providing navigation software to General Dynamics. Boeing Military Aircraft Company, Wichita, KS is the cruise missile integration contractor responsible for B-52G modification and integration. Air Launched Cruise Missile development and initial production were managed by the Joint Cruise Missiles Project Office with the Navy as lead service. Rear Admiral Walter M. Locke was Program Director. The Air Launched Cruise Missile responsible test organization is the Air Force Flight Test Center, Edwards Air Force Base, CA. The Air Force Test and Evaluation Center is the independent operational test agency for Air Launched Cruise Missile. The Aeronautical Systems Division at Wright-Patterson Air Force Base, OH assumed Air Launched Cruise Missile program management responsibility in April 1980 with Brigadier General Melvin F. Chubb as Program Director. Management transfer occurred after the 17 April 1980 production decision which approved full rate Air Launched Cruise Missile production. Engine and navigation/guidance systems management still remains with the Joint Cruise Missiles Project Office.

(U) Testing of the missile was conducted out of the Air Force Flight Test Center using primarily the Utah Test and Training Range and Pacific Missile Test Center. A combined test team consisting of Air Force Flight Test Center and Air Force Test and Evaluation Center personnel conducted the tests under the management of the Joint Cruise Missiles Project Office. During the flyoff, 10 AGM-86Bs and 7 AGM-109s (3 were refurbished and reflown) were tested.

(U) The majority of the reliability and maintainability testing will be conducted during the follow-on test program when sufficient production configured support equipment is available. During the flyoff the contractors were expected to demonstrate a test reliability of .575 to .744 for a hypothetical mission of 12 hours captive carry and 5 hours of free flight. A value of .68 was achieved. Ground test demonstrations conducted during the flyoff were evaluated as part of the competition. These included pylon/launcher loading, Air Launched Cruise Missile vehicle exchanges, payload exchange and limited capability electronic systems test set testing. These tests were conducted by Air Force Flight Test Center and Air Force Test and Evaluation Center personnel at Edwards Air Force Base, CA.

Budget Activity: Strategic Programs #3

Program Element: #64361F, Air Launched Cruise Missile

(U) Environmental testing in fiscal year 1979 consisted of static icing tests of the competing missiles. Fiscal year 1980 activities include simulated free flight icing tests of the missile in the Arnold Engineering Test Center wind tunnel and icing flight tests of the missile/pylon/B-52G combination using the KC-135 water spray tanker. The fiscal year 1981 effort will consist primarily of test planning and facility set up for integrated missile/B-52G Offensive Avionics System cold weather tests at the Eglin Air Force Base, FL climatic hanger.

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center is the Operational Test and Evaluation agency responsible for Air Launched Cruise Missile Initial Test and Operation and the early phase of Follow-on Operational Test and Evaluation. Air Force Test and Evaluation Center headquarters is located at Kirtland Air Force Base, NM, and the Air Force Test and Evaluation Center Air Launched Cruise Missile Initial Operational Test and Evaluation test team (Air Force Test and Evaluation Center Air Launched Cruise Missile) is at Edwards Air Force Base, CA. The Initial Operational Test and Evaluation test team comprised approximately 125 personnel from Air Force Test and Evaluation Center, Strategic Air Command, Air Force Logistics Command and Air Training Command. During Follow-on Operational Test and Evaluation approximately 80 personnel from the same commands will be on the Air Force Test and Evaluation Center test team.

(U) A combined Development Test and Evaluation/Follow-on Operational Test and Evaluation is being conducted subsequent to the combined Development Test and Evaluation/Initial Operational Test and Evaluation competitive fly-off between Boeing Aerospace Company and General Dynamics Convair. Selection of the Boeing Aerospace Company AGM-86B was announced on 25 March 1980 after Development Test and Evaluation/Initial Operational Test and Evaluation flyoff. The Defense Systems Acquisition Review Council III which met on 17 April 1980, provided direction for production of 225 missiles in fiscal year 1980, Follow-on Operational Test and Evaluation, continuation of reliability and maintainability efforts and management attention on improving Boeing Aerospace company quality assurance discipline for this program. Plans for Follow-on Operational Test and Evaluation include 34 additional launches before the Initial Operational Capability. The first phase includes twelve launches from the same B-52G Boeing Aerospace Company used during the competition. All other launches will be from B-52G's equipped with the Offensive Avionics System.

(U) The significant milestones remaining in the Air Launched Cruise Missile program are the First Alert Capability in September 1981, and Initial Operational Capability in December 1982, both at Griffiss Air Force Base, NY.

(U) The Combined Test Force, of which Air Force Test and Evaluation Center personnel are a part, is located at Edwards Air Force Base, CA. All flight tests originate from Edwards and most of the support equipment evaluation will be accomplished there. Operational Test and Evaluation flight tests will continue to be conducted over, and between, several western test ranges (Utah Test and Training Range, Tonopah, Pacific Missile Test Range and the Edwards Range). In addition, a series of captive carry flights will continue over the western part of the United States, including Alaska.

Budget Activity: Strategic Programs #3

Program Element: #64361P, Air Launched Cruise Missile

(U) The purpose of Operational Test and Evaluation is to estimate the operational effectiveness and suitability of the Air Launched Cruise Missile system. Operational Test and Evaluation objectives are structured to provide additional information where needed. The additional testing, directed by the Defense Systems Acquisition Review Council III, is designed to provide specific performance parameters to the user and to test required changes before putting the missile on sustained alert. The objectives cover the following areas: operational performance parameters, mission reliability, compatibility and interoperability, survivability, mission planning, availability, logistics reliability, maintainability, logistics supportability, and support costs, training, human factors, and software suitability.

(U) Testing of the Air Launched Cruise Missile was affected by a number of issues both internal and external to the program. Fiscal and time constraints limited the number of actual missile launches to 10 per contractor during the competition and delayed availability of some pieces of support equipment at the test site until after the production decision. Action is being taken to reduce the effect of these constraints. Updating of the B-52G with the Offensive Avionics System has also caused some change in Initial Operational Test and Evaluation programs for both systems. Several Air Launched Cruise Missile test objectives are delayed until an Offensive Avionics System equipped B-52G is available to allow testing in conjunction with the Offensive Avionics System test program instead of the Air Launched Cruise Missile test program. Examples of these objectives include assessments of: total system mission reliability; interoperability; compatibility; and some maintainability and logistics supportability characteristics.

(U) Operational effectiveness test results to date are inconclusive with the exception of mission reliability for which the data clearly indicates that substantial improvements are required. Operational effectiveness areas that are satisfactory include range, time of arrival function, selection of alternative mission profiles, arming and fusing, missile status monitoring and B-52G flight handling characteristics. Operational performance of the AGM-86B, including accuracy, terrain following and launch envelope definition, is undetermined. Under the logistics evaluation, availability, logistics supportability (excluding technical data), training and human factors are all satisfactory. The technical data portion of logistics supportability is deficient. Mission planning system capability and overall suitability of software are undetermined. However, the AGM-86B should be capable of performing its assigned mission and will be logistically supportable.

(U) The Joint Cruise Missiles Project Office conducted Phase I of cruise missile survivability testing between January and September 1978. Seven test flights were flown with the TOMAHAWK Sea Launched Cruise Missile version against representative airborne and ground defensive threats to obtain generic detection and tracking data. Further Air Launched Cruise Missile special survivability data was obtained during the competitive flyoff with both Air Launched Cruise Missile versions. Results from these competitive flights (Phase II Air Launched Cruise Missile Survivability) are being merged with the generic Phase I data to determine any remaining requirements for survivability testing during Air Launched Cruise Missile Follow-on Operational Test and Evaluation.

Budget Activity: Strategic Programs #3
 Program Element: #64361F, Air Launched Cruise Missile

(U) An integrated weapon system Follow-on Operational Test and Evaluation program is planned for the Air Launched Cruise Missile on Offensive Avionics System equipped B-52G aircraft from October 1981 through December 1982. This program will start at Edwards Air Force Base and transition to Griffiss Air Force Base (the first operational base) in early/mid 1982.

(U) Strategic Air Command will manage the Air Launched Cruise Missile Follow-on Operational Test and Evaluation following Initial Operational Capability, after the first wing is fully equipped with missiles, support equipment and trained personnel.

3. System Characteristics: Performance data are Decision Coordinating Paper thresholds/goals.

Physical Characteristics

Boeing
 AGM-86B

Length (feet)	20.75
Diameter (inches)	27.3
Weight (pounds)	3144
Wing Span (feet)	12.0
Wing Area (square feet)	11.0
Warhead Yield (kilotons)	
B-52 Internal Carriage (each)	8
B-52 External Carriage (each)	12

Performance Data

	<u>Threshold</u>	<u>Goal</u>	<u>Demonstrated</u>
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Maximum Low Altitude Speed (Mach number)			
Minimum Launch Altitude (feet)			
Minimum Enroute Altitude (feet)			
Propulsion Range (kilometers)	2500	2500	
Systems Operational Range (kilometers)			
Accuracy (Circular Error Probable) (feet)	2/		

1/ Low altitude at Mach /

2/ At Mach /

feet.

2/(U) Extrapolated flight test data.

4/(U) Median accuracy value due to lack of large enough statistical sample to establish Circular Error Probable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64406F
DoD Mission Area: Space Defense, #123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	82,298	109,873*	180,900	190,490	Continuing	Not applicable
2134	Miniature Systems	63,898	82,473	162,600	173,690	Continuing	Not applicable
2135	Advanced Systems	1,500	2,100	500	700	Continuing	Not applicable
2241	Instrumented Target Vehicle	16,900	25,300	17,800	16,100	Continuing	Not applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is developing and testing antisatellite (ASAT) systems in response to guidance contained in National Security Council/Presidential Directive -37 (National Space Policy). First flight test: Initial Operational Capability: These systems are designed to remove the sanctuary status the Soviets currently enjoy in space by providing a capability to deny them the use of those space assets which enhance the effectiveness of their land, sea and aerospace forces.

(S) BASIS FOR FY 1982 RDT&E REQUEST: This request funds the continuing development of the baseline Prototype Miniature Air-Launched System (PMALS) antisatellite, development of an Instrumented Target Vehicle (ITV) to serve as an orbital target for ASAT testing and limited investigations into the possible application of high energy lasers as ASAT weapons. Cost figures are based on contractor cost proposals and System Program Office cost estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	80,500	110,400	99,400	-	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (PE 12450F)						
- Aircraft Modification	0	0	0	4,800	Continuing	Not Applicable

* Re-programming action to add \$24,000,000 has been submitted to Congress. This Descriptive Summary has been written assuming this request will be approved.

Program Element: #64406F

DoD Mission Area: Space Defense, #123

Title: Space Defense Systems (Antisatellite)

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND: The ability of the Soviet Union to use military power on a worldwide basis is increasingly dependent on effective and reliable operation of various satellite systems. These systems enhance the performance of Soviet surface, sea and aerospace forces and Soviet satellite population. The present-day Soviet military satellite population relies on military space support is growing at a rapid pace. First and foremost, the U.S. has a legitimate need for an active satellites on orbit. Currently, the United States has no nonnuclear capability to deny the Soviets the use of space for strategic and tactical forces support. Air Force antisatellite systems are being developed to deny the Soviets the use of space as a force multiplier and to remove the current sanctuary status the Soviets enjoy in the space environment.

The Air Force antisatellite (ASAT) program is also a response to the demonstrated Soviet ASAT capability. In the absence of a comparable United States system or comprehensive and verifiable negotiated limits on ASAT systems, the Soviet ASAT program raises the prospect of a unilateral Soviet military advantage which could also have adverse political implications. Such an advantage, detrimental to the United States. It would provide options to the Soviets during crisis and conflict that the United States could not match.

The primary effort funded by this program is the development and test of a Miniature System ASAT. Miniature System ASATs can be ground or air-launched. The baseline system is the Prototype Miniature Air-Launched System (PMALS) consisting of a modified Short-Range Attack Missile first stage, a modified ALTAIR III second stage and a Miniature Vehicle terminal warhead stage. Kill mechanism is

convention antisatellite system using an explosive warhead was completed in . This design effort was pursued to assure the availability of a physical-attack antisatellite system in the if PMALS experiences severe technical difficulty. While the selected conventional antisatellite design will meet this requirement, it will be costly to deploy and will be limited only to low altitude intercepts because of limited boost vehicle energy and guidance radar range.

PMALS is a potentially low cost, lightweight, and highly responsive system. However, it depends on achieving a circular error of probability which involves a moderate-risk development effort. The high payoff in cost effectiveness and operational flexibility has led the Air Force to aggressively pursue this antisatellite option. The Prototype Miniature Air-Launched System (PMALS) proceeded into hardware design and development in the fourth quarter FY 1977. Hardware assembly and test of subsystems commenced in FY 1978. If directed by the Secretary of Defense, this will lead to demonstration flights beginning in against targets being developed under Project 2241, Instrumented Target Vehicle.

(U) An Instrumented Target Vehicle is also being developed to provide a dedicated orbital test target for evaluating ASAT system performance.

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, #3

(U) During the course of this program, the Air Force will continue to participate in the DoD ground and space-based laser studies so when this technology matures, lasers can be evaluated for use as antisatellite weapons. The results of the Congressionally-directed study on high-energy laser antisatellite and ballistic missile defense applications (due to the Senate Armed Services Committee in March 1981) will significantly influence the nature and scope of future Air Force investments in this area.

(U) RELATED ACTIVITIES: This program is part of an integrated Space Defense Systems Program effort involving four functional areas: Antisatellite, Space Surveillance, Satellite Systems Survivability, and Command and Control. Program Element 63438F, Satellite Systems Survivability, is developing techniques to enhance the survivability of United States space systems. Program Element 63428F, Space Surveillance Technology, is developing improved surveillance capabilities to support ASAT targeting. Program Element 12311F, North American Air Defense Command Combat Operations Center, and Program Element 12424F, SPACETRACK, provide the needed tracking capability and command and control so the ASAT system can be targeted.

(U) WORK PERFORMED BY: Air Force Systems Command Space Division in Los Angeles, CA, manages this program. Aerospace Corporation, El Segundo, CA, provides technical support. PMALS contractors are: Vought Corporation, Grand Prairie, TX, and Boeing Aerospace Corporation, Seattle, WA. AVCO, Wilmington, MA, is developing the Instrumented Target Vehicle. The Arnold Engineering Development Center and Air Force Systems Command Space and Missile Test Organization are both supporting the PMALS development and test efforts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Two Miniature System ASAT concepts were pursued through preliminary design. The Vought/Boeing team was selected in the fourth quarter FY 1977 for development and ground tests. In 1978 the program was restructured to provide a prototype miniature antisatellite system to be launched from an airplane with an option for the development of ground launched system if requirements dictate. The design of the ground-test configuration has been approved by the Air Force and assemblies of the miniature vehicle have undergone ground testing. An Air Force review of the PMALS preliminary design has been completed. Wind tunnel tests have been performed to define missile aerodynamic configuration. The preliminary design of the mission control segment to support ASAT testing has been completed. In June 1980, contracts were awarded to the Vought and Boeing Corporations for completion of final design and a flight test program. The conventional antisatellite preliminary design efforts have been completed and all contractual efforts were completed in

(U) Detailed design of the Instrumented Target Vehicle to support ASAT flight testing was initiated following award of the development contract to AVCO Corporation in May 1979. An Air Force review of the design was accomplished in FY 1980.

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, # 3

(U) Laser systems have been and will be continually reviewed for possible advanced antisatellite (ASAT) applications. A Congressionally-directed mission analysis for a multi-mission space-based laser has been initiated.

2. FY 1981 Program: Detailed design of the Prototype Miniature Air-Launched System (PMALS) interceptor, carrier aircraft equipment, F-15 aircraft modifications and support equipment will continue.

The critical flight functions of the MV will be tested. Software for the flight-test program will be reviewed by the Air Force and coding will start. PMALS integration efforts will accelerate.

Final development and qualification testing for the Instrumented Target Vehicle (ITV) will be completed.

(U) The mission analysis for the space-based laser ASAT will be completed and a trade-off study of alternate systems for a space-based laser ASAT will be done. Planning of the system design and definition of required technology developments will be made for the space-based laser ASAT. Investigations will continue into possible new advance ASAT efforts such as particle beams.

3. FY 1982 Planned Program: Detailed design of PMALS will continue.

System integration and test efforts will continue toward certification of the prototype's readiness for flight test.

Activities at the Air Force Flight Test Center at Edwards AFB, CA will first flight of the Miniature System ASAT. Testing of the interfaces between the ITV and Investigations will accelerate toward the its Scout booster will begin.

continue on possible new advanced ASAT techniques such as lasers and particle beams. The \$81.5 million increase in the cost estimates for FY 1982 reflects revised Air Force estimates of total program costs and the transfer of approximately 25 million dollars from PE 12450F, Space Defense Operations (see footnote, page 1, PE 12450F).

4. FY 1983 Planned Program:

be completed on the missile and carrier aircraft equipment.

Investigations will continue into possible advanced ASAT techniques. Flight worthiness testing will

5. Program to Completion: This is a continuing program. If a space test is directed by the Secretary of Defense, The program will continue to support, as required, the deployment of an operational ASAT capability. This

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Space Defense Systems (Antisatellite)
Budget Activity: Strategic Programs, # 3

6. (U) Milestones:

a. (U)	Start Fabrications of ground-test Instrumented Target Vehicles	Oct 1980
b. (U)	Missile/Carrier Aircraft Equipment Software Design Review	Mar 1981
c. (S)	Miniature Vehicle (MV) Ground Test Complete	
d. (U)	MV Flight Software Design Review	Jul 1981
e. (S)	Start Fabrication of Flight-Test Missiles	
f. (U)	Initiate Modification of Flight-Test Carrier Aircraft (F-15s)	Sep 1981
g. (S)	Modified F-15s Available for Test	
h. (S)	MV Qualification Test Complete	
i. (S)	First Missile Captive Flight Test	
j. (S)	Missile Flight-Worthiness Test Complete	
k. (S)	First Instrumented Target Vehicle On-Orbit	
l. (S)	First Flight Test	
m. (S)	Initial Operational Capability	

Budget Activity: Strategic Programs, #3
Program Element: #64406F, Space Defense Systems

Test and Evaluation Data

1. (U) Development Test and Evaluation: All subsystem Preliminary Design Reviews on the Prototype Miniature Air-Launched System have been successfully completed. The Missile/Carrier Aircraft Equipment Preliminary Design Review was successfully held in January 1980 and the Critical Design Review is now scheduled for September 1981. The supporting Mission Control Segment Preliminary Design Review was conducted in October 1980 and the Critical Design Review is scheduled for August 1981. A number of major subsystem and system development tests have been conducted:

Early development testing focuses on the Miniature Vehicle assembly performance. A critical subsystem of the Miniature Vehicle is the sensor used to the target satellite. The baseline sensor was developed by Hughes Aircraft Corporation and tested at the Arnold Engineering Development Center, TN. Testing was performed in a vacuum chamber and Arnold Engineering Development Center sources were used to establish the calibrated levels. The tests were designed to measure sensor sensitivity, responsiveness, noise level, and dynamic range. Off-axis signal rejection tests were performed at Hughes. Test results indicated that both

As a result of these tests, the Aerojet Corporation was funded to develop a second source
This differs from the Hughes in that Aerojet uses a different and the

During tests at the Naval Ocean System Center, the Aerojet exhibited a distinct performance advantage over the Hughes but was out of specification by approximately The Aerojet has been selected to replace the Hughes in the baseline Miniature Vehicle design and efforts are underway to bring the Aerojet up to specification requirements. Testing of the sensors developed for ground test has surfaced some test problems related to the use of a

Design solutions are progressing.

The Maneuver Propulsion Assembly is used to maneuver the Miniature Vehicle after release from the Short-Range Attack Missile/ALTAIR III booster and provides propulsion A series of single-motor tests was conducted to evaluate, among other things, igniter performance, burn rates, nozzle erosion and ballistic performance of the baseline tapered grain design. However, in the rapid-fire testing during qualification, nozzle ring temperatures exceeded predictions by about percent and data show there may still be Design modifications are currently being evaluated.

The issue of Miniature Vehicle has been addressed in a series of sub-scale models. The

tests which utilized

A series of tests were

114C

146

Budget Activity: Strategic Programs, #3
Program Element: #64406F

completed at Arnold Engineering Development Center on' Additional tests will be conducted at Arnold Engineering Development Center in February 1981 and full-scale predictions should be available in

(U) Wind tunnel aerodynamic testing at Arnold Engineering Development Center utilizing scale models of both the missile and aircraft have been performed. Configuration changes based upon autopilot stability requirements have led to lower stage fin redesign and supplemental wind tunnel tests at Arnold Engineering Development Center with attention focused on the selection of a baseline missile configuration. Solid plume and blowing exhaust plume tests have been conducted to evaluate rocket plume and fin interaction effects. A revised baseline missile configuration has been selected and tested. This configuration satisfies auto-pilot stability and missile control requirements in the presence of rocket plumes.

(U) Development, Test and Evaluation flight tests will be conducted primarily over the Western Space and Missile Center ranges, though there will be some captive flights over the Air Force Flight Test Center range. The missiles will be assembled and the aircraft will be based at Air Force Flight Test Center. Elements of both the Development, Test and Evaluation and Operational Test and Evaluation test teams will reside at both Western Space and Missile Center and Air Force Flight Test Center.

(U) Management of the Development, Test and Evaluation and the flight test program will reside within Air Force Systems Command. However, Air Force Test and Evaluation Center directed Initial Operational Test and Evaluation requirements will be incorporated into the flight test program to the maximum extent practical to facilitate both Development, Test and Evaluation and Initial Operational Test and Evaluation. Data from the following tests will be made available to Air Force Test and Evaluation Center who will independently evaluate and report Initial Operational Test and Evaluation results.

(U) The F-15 aircraft will be tested to determine its performance characteristics when configured with the missile system. The initial aircraft tests will evaluate the navigation accuracy of the Prototype Miniature Air-Launched System. The tests will include a series of captive-carry (no planned missile separation) flights utilizing an instrumented missile. The tests will also determine/evaluate dynamic characteristics such as acoustic noise, vibration, loads and flutter and aerodynamic heating effects on the missile subsystems/subassemblies.

(U) Box launch tests of representative missiles will be performed in order to demonstrate software, hardware, timing, safing/arming, travel and interlock performance functions. Test activity will be performed at contractors' facilities without aircraft and repeated at the test base with the aircraft.

(U) Flight test activity will include pre-flight ground operations, flight communications, mission control functions, mission tape loading, aircraft flight, missile launch, missile flight and aircraft recovery. Missile flight will be evaluated for guidance and navigation performance/accuracy, missile launch, propulsion performance, missile structural dynamics and loads, missile environment, stage separation characteristics and upper-stage pointing.

Budget Activity: Strategic Programs, #3
Program Element: #64406F

The above tests lead to a series of tests, which include deployment and operation of a Miniature Vehicle against an Instrumented Target Vehicle Satellite. A flight test matrix will ensure a variety of intercept conditions are encountered during the test program. Instrumentation and range safety packages will be added to the missile for the flight test program. Exoatmospheric flight tests will be the only opportunity to demonstrate the entire mission. All other tests on the ground involve simulated or short portions of an actual mission. The flight test program will demonstrate sustained free flight of the missile and the Miniature Vehicle in an operational environment. The use of the Instrumented Target Vehicle as a target during the flight testing provides a controlled known and a measurement of the miniature vehicle however, contingency engagement planning will be accomplished for up to three (3) Resident Space Objects.

2. (U) Operational Test and Evaluation: The initial operational test and evaluation of the Prototype Miniature Air-Launched System of the Space Defense System Program will be conducted by the Air Force Test and Evaluation Center, with personnel and assistance from the Aerospace Defense Center, Tactical Air Command, Strategic Air Command, Air Force Logistics Command, Air Force Communications Command, and Air Training Command as part of a combined Development, Test and Evaluation/Initial Operational Test and Evaluation program. Initial Operational Test and Evaluation will provide test information to support scheduled decision milestones and to support a declaration of initial operational capability. More specifically, Initial Operational Test and Evaluation will evaluate the effectiveness and suitability of the antisatellite system and the capability of surveillance, command and control, and communications systems to provide adequate support. Test and evaluation is currently scheduled to commence in December 1982 and is expected to be complete approximately December 1984.

(U) Initial Operational Test and Evaluation will accomplish the following major objectives. Evaluate:

- (U) The capability of the surveillance sensors to collect and provide ephemeris data on designated targets with the required degree of accuracy and timeliness.
 - (U) The capability of command and control elements to perform all required functions, to include decision making, and dissemination of execute, recall, terminate and other commands.
 - (U) The capability of the communications system to pass required information between system elements in an accurate and timely manner.
 - (U) The capability to launch the Prototype Miniature Air-Launched System missile, with associated dispenser and miniature vehicle, from the F-15 aircraft within required accuracy and timeliness constraints.
- The capability of the miniature vehicle to
- (U) System suitability, to include reliability, availability, maintainability, logistic supportability, and compatibility with other systems, computer hardware and software.

Budget Activity: Strategic Programs, #3
Program Element: #64406F

(U) The Initial Operational Test and Evaluation will be accomplished through evaluation and demonstration of the various system segments and tests of the entire system. Segment tests will evaluate the performance capabilities of individual system segments such as surveillance sensors, command and control elements, communications systems, etc. System testing will involve dry runs to exercise and evaluate all system segments to the point of weapon launch. Flight tests, under the direction of the Air Force Systems Command, will involve all segments and include launching the weapons against an Instrumented Target Vehicle, a specialized target vehicle developed by AVCO Corporation. In addition, at least one launch will be planned against a resident space object. Air Force Test and Evaluation Center will independently evaluate live-fire test data and will use simulation and analyses to supplement live-fire test results.

Prototype weapons and equipment, developed by Boeing and Vought Corporations, will be used for testing during Development Test and Evaluation/Initial Operational Test and Evaluation.

(U) Primary test team elements will be located at Vandenberg Air Force Base, CA; Edwards Air Force Base, CA; and the North American Air Defense Command Cheyenne Mountain Complex, CO. Captive-carry and other segment tests will be conducted on the Air Force Flight Test Center range. Other captive-carry, dry run and live-fire tests will involve flying from Edwards Air Force Base to the Western Test Range near Vandenberg Air Force Base, CA, where flight tests will be monitored by Western Test Range sensors. The Air Force Satellite Control Facility will control and track the instrumented test vehicles. Evaluators located in the North American Air Defense Command Cheyenne Mountain Complex will evaluate mission operations center actions.

The number of test articles to be available for testing is as follows: (These test articles are not in addition to Development Test and Evaluation resources).

Prototype Miniature Air-Launched System missile launches.

- (U) Two modified aircraft with associated pylons, carrier aircraft equipment, support equipment, etc.
- (U) A simulation model of weapon performance from launch of the missile from the aircraft to impact.
- (U) Instrumented Target Vehicles to support all live fires.
- (U) A minimum of 93 captive-carry hours.

There will be a total of missiles procured for the test program and Initial Operational Capability residuals.

(U) Reliability, availability and maintainability test and evaluation will be conducted using resources available, support and test support equipment, and captive-carry missions. Reliability, availability and maintainability goals have not yet been established. Initial evaluations will assume contractor maintenance and support for the life of the system; however, Air Force Test and Evaluation Center will perform "Blue Suit versus contractor" evaluations to recommend the proper mix of Blue Suit and contractor maintenance personnel.

Budget Activity: Strategic Programs, #3
 Program Element: #64406F

(U) Follow-on Test and Evaluation will be conducted by Air Force Test and Evaluation Center (phase I) and the using command (phase II). Production weapons and using-command aircraft will be used to test areas not adequately tested during initial operational test and evaluation, changes, and deficiency correction.

3. (U) System Characteristics:

First Stage: Standard Short Range Attack Missile plus three fixed fins and two modified variable fins

	<u>Objective</u>	<u>Demonstrated</u>	<u>Method</u>
- Weight:	(Pounds)	7511	Measurement
- Thrust:	(Pounds)	-65 to +145	Ground Test
- Temperature:	(Degrees Fahrenheit)	252,800	Environmental Test
- Total Impluse:	(Pound-seconds)		Ground Test

(U) Second Stage: Standard ALTAIR III with minor structural modifications and reaction control system.

- Weight	(Pounds)	671	Measurement
- Thrust	(Pounds)	5,950	Ground Test
- Burn Time	(Seconds)	27.4	Ground Test
- Total Impluse	(Pound-seconds)	170,000	Ground Test

Miniature Vehicle

- Sensor
- Weight (Pounds)
- Dimensions (Inches)
- Destruct Mechanism

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Project: # 2134

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Miniature Systems

Title: Space Defense Systems (Antisatellite)

Budget Activity: Strategic Programs, # 3

DETAILED BACKGROUND AND DESCRIPTION:

United States antisatellite (ASAT) development efforts were accelerated in January 1978 following promulgation of Secretary of Defense guidance to "vigorously pursue" an ASAT capability. This guidance followed growing recognition of (1) the growing asymmetry between the U.S. and the Union of Soviet Socialist Republics (USSR) in ASAT capabilities and (2)

Thus, the development of an ASAT capability will enable the U.S. to respond to a Soviet ASAT attack by providing the means to destroy Soviet satellites which enhance their war fighting capabilities.

Air Force ASAT development efforts have concentrated on miniature,

This type of system is cost effective, operationally flexible and has growth potential for attacks against high-altitude targets. The baseline ASAT system, currently in prototype development consists of a modified Short-Range Attack Missile first stage, an ALTAIR III second stage and a Miniature Vehicle (MV) terminal warhead stage. This Prototype Miniature Air-Launched System (PMALS) ASAT weighs approximately pounds and is designed to attack targets at altitudes less than nautical miles. The MV warhead weighs approximately pounds, is approximately inches, uses a sensor to detect and track a target satellite and, using small rockets, systems.

Competitive design contracts for the PMALS were carried through preliminary design review in FY 1977. A Vought Corporation design for a was selected in the fourth quarter FY 1977 for full-scale development. The Vought design will be developed and ground-tested through Contracts to Vought and Boeing were let in FY 80 for the flight test of the PMALS. Assuming Secretary of Defense go ahead, the first flight demonstration would occur in against an Instrumented Target Vehicle being developed under Project 2241.

(U) RELATED ACTIVITIES: Program Element (P.E) 63428F, Space Surveillance Technology, develops the satellite targeting sensors so the range and the prediction accuracy of SPACETRACK can be improved. This supports the PMALS program by reducing the maneuvering requirements during the attack engagement and enhancing the probability of kill. P.E. 12311F, North American Air Defense Command Combat Operations Center, is developing the Space Defense Operations Center to provide the command control of ASAT operations.

(U) WORK PERFORMED BY: Air Force Systems Command Space Division, formerly Space and Missile Systems Organization, in Los Angeles, CA, manages this program. The primary contractors are LTV Corporation, Grand Prairie, TX, and Boeing Aerospace Corporation, Seattle, WA. Aerospace Corporation, El Segundo, CA, provides technical support.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Two competitive Miniature Vehicle (MV) design efforts were initiated in FY 1976. The efforts included the preliminary design of the MV and the spin-up and release mechanism, limited system

Project: # 2134

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Miniature Systems

Title: Space Defense Systems (Antisatellite)

Budget Activity: Strategic Programs, #

simulations and cost trade-offs against variations in mission requirements and investigations into MV booster interfaces and deployment concepts. In the fourth quarter of FY 1977, the Vought Corporation design was selected for Prototype [Miniature Air-Launched System (PMALS)] development leading to demonstration flights beginning in Selection was primarily based on system performance, risk as defined by hardware state-of-the-art, applicability to existing booster systems, and cost. FY 1979 efforts included development at Arnold Engineering Development Center, redesign of the flight computer for more storage capacity and bench tests of attitude control sub-systems. Carrier aircraft and PMALS engineering interfaces were further refined and targeting algorithm design was initiated. FY 1980 efforts included aircraft/missile wind tunnel testing at the Arnold Engineering Development Center (AEDC). These tests determined aircraft/missile aerodynamic characteristics.

Contracts were let to Vought and Boeing for

of PMALS.

2. FY 1981 Program: Detailed design of the Miniature Vehicle (MV), air-launched missile, carrier aircraft equipment, F-15 aircraft modifications and support equipment will continue.

This will include a number of drop tests to develop a detailed statistical model of the MV's ability to detect and track a simulated target. Integration testing will be conducted with the MV and its spin-up mechanism. A major design review to authorize the fabrication of and coding of software are scheduled.

3. FY 1982 Planned Program: Detailed design will continue.
design review to authorize the fabrication of
equipment will start.

A major
Ground testing of missile and PMALS carrier aircraft

4. FY 1983 Planned Program:

on the missile and carrier aircraft equipment. System integration and test efforts will continue toward certification of the prototype's readiness for flight test.
Activities at the Air Force Flight Test Center and Edwards AFB, CA will accelerate toward the of the PMALS antisatellite.

5. Program to Completion: This is a continuing program. If directed by the Secretary of Defense,

This Program Element will continue to support the PMALS through transition to an operational capability.

Project: # 2134

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Miniature Systems

Title: Space Defense Systems (Antisatellite)

Budget Activity: Strategic Programs, # 3

6. (U) Milestones:

- | a. (U) Missile/Carrier Aircraft Equipment Design Review
- | b. (U) Miniature Vehicle Ground Test Complete
- | c. (U) Miniature Vehicle Flight Software Design Review
- | d. (U) Start Flight Test Missile Fabrication
- | e. (U) Start Flight Test Carrier Equipment Fabrication
- | f. (U) Miniature Vehicle Qualification Test Complete
- | g. (U) First Modified F-15 Test Aircraft Available
- | h. (U) First Missile Captive Flight Test
- | i. (U) Missile Flight-Worthiness Test Complete
- | j. (U) First Flight Test
- | k. (U) Last Test Flight

March 1981
July 1981
September 1981

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
RDT&E - Miniature Systems	63,898	82,473	162,600*	173,690		

Procurement (PE 12450F)
-Aircraft Modification

0 0 0 4,800 Continuing Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E - Miniature Systems	63,000	77,400	65,200*	-	Continuing	Not Applicable
Procurement (PE 12450F) -Aircraft Modification	0	0	0	-	Continuing	Not Applicable

| *See paragraph 3, page 4, "FY 1982 Planned Program" for comment on cost increases.

Project: #2241

Program Element: #64406F

DoD Mission Area: Strategic Defense, #123

Title: Instrumented Target Vehicle

Title: Space Defense Systems (Antisatellite)

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Instrumented Target Vehicles (ITV) are required as orbital test targets to evaluate the effectiveness of the antisatellite system being developed by Project 2134, Miniature Systems. The Instrumented Target Vehicle will contain sufficient on-board instrumentation for determining destruction and for assisting ground tracking stations in collecting antisatellite performance parameters;

The objective of this program is to collect sufficient antisatellite performance information so that a go/no go decision can be made on deployment of the system. For the Prototype Miniature Air-Launched-System with its Miniature Vehicle warhead, the target will be required to resolve

Miniature Vehicle specifications call for a circular error probable of

The chosen concept is a six-and-one-half foot diameter balloon with variable

Two to three Instrumented Target Vehicles will be launched using SCOUT boosters.

(U) RELATED ACTIVITIES: This project is required to support Miniature System flight demonstrations conducted under Project 2134.

(U) WORK PERFORMED BY: This project is managed by Air Force Systems Command's Space Division, Los Angeles, CA. The Aerospace Corporation, El Segundo, CA, provides technical support. AVCO Corporation, Wilmington, MA, was awarded the development contract for the Instrumented Target Vehicle in May 1979.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Preliminary designs for the ITV were examined under Project 2134, Miniature Systems. A survey was conducted of all Department of Defense instrumentation agencies to identify existing off-the-shelf hardware and techniques that could be applied to the development of a target vehicle. Analyses were performed to establish initial use of existing orbital objects or piggyback payloads as antisatellite targets was examined and found to be unsatisfactory. Only a dedicated and adequately instrumented target could verify antisatellite performance. AVCO Corporation won the competitive procurement for this effort. Subsystem development tests have been completed. The flight-test contract option was exercised.

2. FY 1981 Program: Development of the ITV will continue. Subsystem qualification testing will be completed. Performance tests in vacuum and zero-gravity drop tests will be completed. Fabrication of ITVs for the Miniature Vehicle flight test program will begin.

3. FY 1982 Planned Program:

Project: #2241

Program Element: # 64406F

DoD Mission Area: Space Defense, # 123

Title: Instrumented Target Vehicle

Title: Space Defense Systems (Antistellite)

Budget Activity: Strategic Programs, # 3

4. (U) FY 1983 Planned Program: Fabrication of the ITVs for the PMALS flight test program will be completed. Four flight-test ITVs will be launched to support the MV flight tests.

5. Program to Completion: Assuming a successful development test and engineering effort for the PMALS, this program will complete in the time period which requires an extension to the current contract. Target vehicles for advanced ASAT technique such as laser may require additional Research, Development, Test and Evaluation funding in the out years.

6. (U) Milestones:

- a. (U) Instrumented Test Vehicle Contract Award
 - b. (U) Design Review to Authorize Fabrication
 - c. (S) Performance Tests Complete
 - d. (S) Qualification Tests Complete
 - e. (S) Launch First Vehicle (2 ITVs)
- May 1979
September 1980

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	
RDtLE	16,900	25,300	17,800	16,100	Continuing		Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDtLE	16,000	26,000	22,200	13,400	Continuing		Not Applicable
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See paragraph 3, page 4, "FY 1982 Planned Program" for comment on cost increases.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64711F

Title: Systems Survivability (Nuclear Effects)
 Budget Activity: Strategic Programs #3

DOD Mission Area: Airborne Strike, #113

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs N/A
TOTAL FOR PROGRAM ELEMENT							
2485	S/V Assessment of C3 Systems	1,600	1,600	2,200	2,600	Continuing	N/A
3763	S/V Assessment of Aerospace Systems	9,400	8,780	6,100	6,800	Continuing	N/A
4695	S/V Assessment of Satellites	3,000	3,500	4,000	4,900	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The thrust of this program is to assess, through analysis and testing, the effects generated by a nuclear weapon on the survivability/vulnerability (S/V) of Air Force aerospace (aircraft, missiles), command and control communications (C3) systems and satellites, and to develop the engineering technology for hardening these systems.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program will develop and use analytical techniques and the electromagnetic pulse (EMP) and system generated EMP (SGEMP) test facilities needed to assess the nuclear S/V of aerospace systems associated structures (Project 3763), ground based C3 systems and communications network overlays (Project 2485), and satellites and communication links (Project 4695). Cost based primarily on historic data, continuing existing contacts, and starting new ones.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs N/A
RDT&E	14,200	13,904	13,200			N/A

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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Program Element: 64711P

DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)

Budget Activity: Strategic Programs #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 80 and Prior Accomplishments: In Project 2485, an Air Force Strategic Command, Control and Communications (C3) Data Base, directed by Program Management Directive was initiated to cover all projects. A ground based High Altitude Radiation Detection System was also developed, tested, and installed at an operational location. An Electro-magnetic Pulse (EMP) validation test of the Defense Support Program satellite simplified processing stations was complete. Inputs for redesign of an Air Force Satellite Communications System modem to mitigate propagation disturbances were provided the Program Office. Final hardening design of Ground Launched Cruise Missile C3 systems was completed. Fiber optics have great potential as nuclear hardening technique and technology development was started. The tactical and strategic C3 review was completed. Hardening inputs for communication ground terminals was initiated. PAVE PAWS Electromagnetic Pulse Survivability (S/V) Studies were continued. A hardened screen room for the Strategic Air Command has been designed, constructed, and tested. Electromagnetic pulse shielding was designed for the Operational Support Center for US Air Force Europe. Planning for an on-site test of the shield integrity was initiated.

In Project 3763, An EMP assessment was performed on the EC-135, E-3A, E4B, B-52, the Navy C-130 Take Charge And Move Out (TACAMO) Aircraft and the Air Launched Cruise Missile. An evaluation of EMP upset and permanent damage for E-4 subsystems was completed. Analytical tools to address external coupling, deliberate antennas and aircraft inadvertent penetrations were developed. A corona study on trailing wire antennas and an in-flight EMP test of the Navy TACAMO aircraft with trailing wire extended were completed. A system level analytical model was developed for the B-1. An advanced Intercontinental Ballistic Missile System nuclear technology requirements study was started. Nuclear blast, thermal and shock effects on aerospace systems were studied to develop necessary hardening techniques and guidelines for Program Offices. These techniques and others were integrated into the technology data base. The EMP assessment of the advanced fighter aircraft using the F-16 as the test-bed was started.

In Project 4695 a Laboratory System Generated EMP experimental program to include development of low-level photon sources and their use in analysis and testing of complex satellite models and subsystems was started. The laboratory system generated EMP experimental program received increased emphasis. Satellite systems Fleet Satellite Communications System, Strategic Satellite System, Defense Communications Satellite System, Air Force Satellite Communications System, and Global Positioning System were assessed for nuclear S/V, and alternate means of hardening were provided to the Program Offices as design guidelines. The application/validations of current hardening techniques were addressed in conjunction with limited simulation techniques verification and validation. Further, communication links were analyzed to determine the effect of propagation disturbance due to nuclear environments. A threat level X-Ray source for satellites was completed. The first phase of testing on Fleet Satellite Communications Satellite qualification model hardware was started.

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Program Element: 64711P

DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

2. (U) FY 1981 Program: In Project 2485, the definition of survivable C³ systems will be completed and work on the assessment/validation of the hardness of these systems will be initiated. Hardening of satellite ground terminals, development of fiber optics as a hardening technique and Strategic Air Command (SAC) communications system hardening will all continue. A test of the Electromagnetic Pulse (EMP) shielding for the Operational Support Center will be conducted. A hardness maintenance surveillance system will be designed using the Take Charge And Move Out (TACAMO) aircraft as a test-bed. A tactical nuclear invasion study will also be conducted.
- (U) In Project 3763, the A-7E and F-14 aircraft will undergo EMP testing in the Air Force Weapons Laboratory EMP simulators. The EMP assessment of the advanced fighter aircraft using the F-16 as a test-bed will be completed. The life cycle survivability program for aircraft and missiles involving the Program Offices and the Air Force Logistics Command will continue. Preliminary work for an EMP Assessment of the FB-111 will begin.
- (U) In Project 4695, the Fleet Satellite Communications System Generated EMP (SGEMP) photon tests will be started. Continuing efforts include SGEMP simulation technique development, hardening design guideline development, and satellite communication system network analysis.
3. (U) FY 82 Planned Program: In Project 2485 work on development and validation of survivable overlay C³ systems will continue. EMP hardening of facilities and development of fiber optics as an EMP Hardening Technique will also continue.
- (U) In Project 3763, the total life cycle EMP hardness and hardness assurance program for aircraft and missile systems will continue. Definition of systems upset methodology will be initiated. Alternative Survivability/Vulnerability (S/V) assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations can be reduced/eliminated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile system effectiveness will continue to be developed and/or refined. In the area of system associated structures, testing will be initiated through an iterative process of analysis test, methodology refinement and retest methods will be used to define and verify the final methodology package. The FB-111 Aircraft will be assessed for EMP vulnerability in a joint program with the Defense Nuclear Agency. A joint Air Force/DNA Technology Development Program will be initiated.
- (U) In Project 4695, SGEMP testing will continue. Specific areas will include development and testing of a complex satellite model which will serve as a test-bed for measuring the effectiveness of hardening approaches. Space system S/V integration will continue. Particular areas of emphasis will be analytical support and hardening trade studies. Satellite link performance and mitigation analysis will continue. The upgrading and application of the SCENARIO Code and Propagation Network Assessment Code to Satellite Communication System will be areas of primary emphasis.
4. (U) FY 1983 Planned Program: In Project 2485 work on development and validation of survivable overlay C³ systems will continue. EMP hardening of facilities and development of fiber optics as an EMP Hardening Technique will also continue in Project 3763, the total life cycle EMP hardness and hardness assurance program for aircraft and missile systems will continue. The systems upset methodology scheduled for initiation in FY 1982 will continue. Alternative S/V assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations can be reduced/eliminated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of

Program Element: 64711P

DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)
Budget Activity: Strategic Programs #3

aircraft/missile systems, and fiber optics system will continue. Testing of the Hardness Assessment Maintenance Surveillance (HAMS) system will be initiated. In the area of system associated structures, testing using an interactive process of analysis, test, methodology refinement and retest will continue. The methods will be used to define and verify the final methodology package for assessing the hardness of these structures. In Project 4695, System Generated EMP testing will continue. Specific areas will include development and testing of a complex satellite model which will serve as a test-bed for measuring the effectiveness of hardening approaches. The PIMBS-11 Laboratory X-Ray source will be used to test large area targets. The results will be compared to other test techniques to support system testing and hard verification. Space system Survivability/Vulnerability integration will continue particular areas of emphasis will be analytical support and hardening trade studies. At this time, sufficient experimental and analytical data should exist to sponsor satellites with "point design" hardness to meet specific mission survivability requirements. Satellite link performance and mitigation analysis will continue. The SCENARIO Code and Propagation Network Assessment Code will be upgraded and applied to Satellite Communication System.

5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

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Project: #3763

Program Element: #64711F

DOD Mission Area: Airborne Strike, #113

Title: S/V Assessment of Aerospace Systems

Title: Systems Survivability (Nuclear Effects)

Budget Activity: Strategic Programs #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Project 3763 develops the technology for analyzing and testing the survivability and vulnerability (S/V) response of current and future aerospace systems to nuclear effects. The nuclear effects of interest are: Blast, Electromagnetic Pulse (EMP), Shock, System Generated Electromagnetic Pulse (SGEMP), Thermal, Transient Radiation Effects and X-Rays. The eventual results of these efforts will be hardening techniques for aerospace systems so that they can effectively accomplish their missions in a war-created nuclear environment. The approach used to accomplish the S/V assessment of aerospace systems to nuclear effects is based on several parallel efforts. An effort concerning generic technology, heavily weighted towards assessments capability, is continuing. Included in this generic effort for the future are studies leading to recommendations on how to implement hardness life cycle survivability, military standards and specifications, and production standards and techniques. Parallel with this effort, evaluation and, when appropriate, development of basic analytical and testing techniques to accomplish S/V assessment will be continued. The third parallel effort will include as much support to the Program Office and other organizations in assessing the S/V of their particular aerospace system as the full resources of Project 3763 can accommodate.

(U) RELATED ACTIVITIES: Electromagnetic radiation test facilities required for this project are developed in Program Element (PE) 64747F Project 1209. Related technology for this project is developed under PE 62601 Project 8809, Nuclear S/V Technology.

(U) WORK PERFORMED BY: Air Force Systems Command manages this project through the Air Force Weapons Laboratory, Kirtland Air Force Base, NM. Contractors for various analyses and tests performed under this project include: BDM Corp., Albuquerque; NM: Boeing Company, Wichita, KS; Kaman Avidyne, Burlington, MA; EG&G Albuquerque, NM; Mission Research Corp., Santa Barbara, CA; Physics International, San Leandro, CA; R&D Associates, Marina Del Ray, CA; Science Applications Inc., Albuquerque, NM; TRW, Redondo Beach, CA; General Dynamics, Fort Worth, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1979 and Prior Accomplishments: In Project 3763, an EMP assessment was performed on the EC-135, E-3A, E4B, B-52, the Navy C-130 Take Charge and Move Out (TACAMO) Aircraft and the Air Launched Cruise Missile. An evaluation of EMP upset and permanent damage for E-4 subsystems was completed. Analytical tools to address external coupling, deliberate antennas and aircraft inadvertent penetrations were developed. A corona study on trailing wire antennas and an in-flight EMP test of the Navy TACAMO aircraft with trailing wire extended were completed. A system level analytical model was developed for the B-1. An advanced Intercontinental Ballistic Missile System systems nuclear technology requirements study was started. Nuclear blast, thermal and shock effects on aerospace systems were studied to develop necessary hardening techniques and guidelines for Program Offices. These techniques and others were integrated into the technology data base. The EMP assessment of the advanced fighter aircraft using the F-16 as the test bed was completed. An unhardened B-52 underwent EMP proof testing at the TRESTLE threat level in-flight simulator. A baseline EMP test on an unhardened B-52 was also conducted.

Program Element: 64711F

DoD Mission Area: Airborne Strike, #113

Title: Systems Survivability (Nuclear Effects)

Budget Activity: Strategic Program #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The objectives of this program are to assess the survivability/vulnerability (S/V) of Air Force aerospace and communications systems that may be required to operate in a nuclear environment, and to develop engineering technology for their hardening. The Air Force Nuclear Criteria Group establishes hardness criteria levels for developmental systems early in their design phase and for operational systems upon request. Requirements involving operational systems are provided by using commands. For some types of nuclear weapons effects, available assessment and hardening technology must be extended before application to complex modern systems. The assessments include: analyses to determine the paths and amounts of energy coupled into systems and to identify critical components and circuits; laboratory tests to measure the response of components, circuits, and subsystems to that energy; and simulation tests of full-scale systems to verify analyses and laboratory results, and to increase confidence in the techniques used for system hardening. The development of hardening guidelines uses the assessment results to specify methods to control energy entry into systems and to increase the resistance of susceptible components and subsystems.

The program is currently divided into three projects: Project 2485, S/V Assessment Command and Control Communications (C3) Systems, consists of the development, acquisition, and use of assessment techniques and Electro-magnetic Pulse (EMP) measured test data to determine the nuclear S/V of critical ground command and control communications including data links; Project 3763, Survivability/Vulnerability Assessment of Aerospace Systems, mainly consists of the assessment (analysis and testing) and hardening of aircraft and missiles such as the E-3, E-4, EC-135, F-16, B-52, B-1, FB-111, Air Launched Cruise Missile, Ground Launched Cruise Missile, MX, etc., when they are subjected to various nuclear environments; Project 4695, S/V Assessment of Satellites, consists of the development and use of analysis and testing techniques for the Systems Generated EMP and Transient Radiation Effects to assess space systems and their communications links with primary emphasis on warning, alerting and controlling the strategic forces. Hardening assistance and design guidelines are provided to Strategic Air Command and many Program Offices.

(U) RELATED ACTIVITIES: This Program is related to Air Force programs to develop and maintain a survivable strategic force with associated command and control communications systems. A joint working group between the Air Force, the Defense Communications Agency, and the Defense Nuclear Agency has been established to coordinate command and control communications assessment plans and to effect timely exchange of results. Program Element, 64747F/Project 1209, Nuclear Effects Simulation Test Facilities and Program Element, 62601/Project 8809, Nuclear S/V Technology, Program Element 63438F, Satellite Systems Survivability and PE 63244F, Aircraft Nonnuclear Survivability are related. (Test facilities for this program are acquired under Program Element 64747F, Project 1209, Nuclear Effects Simulation Test Facilities.)

(U) WORK PERFORMED BY: The program is managed by the Air Force Weapons Laboratory, Kirtland AFB, NM and the Aeronautical System Division, Wright Patterson, AFB, Ohio. Contractual work is performed by Nanofact Corporation, Chicago, IL; Textronics, Inc., Beaverton, OR; New Mexico School of Mines, Socorro, NM; T&M Electronics, Albuquerque, NM; University of Arizona, Tucson, AR; EG&G Incorporated, Albuquerque, NM; Computer Sciences Corporation, Falls Church, VA; R&D Associates, Santa Monica, CA; TRW, Incorporated, El Segundo, CA; Intelcom Radiation Technology, San Diego, CA; Mission Research Corporation, Santa Barbara, CA; Physics, La Jolla, CA; and Mission Research Corporation, Albuquerque, NM.

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Project: #3763

Program Element: #64711P

DOD Mission Area: Airborne Strike, #113

Title: S/V Assessment of Aerospace Systems

Title: Systems Survivability (Nuclear Effects)

Budget Activity: Strategic Programs #3

2. (U) FY 1981 Program: The A-7E and F-14 aircraft will undergo EMP testing in the Air Force Weapons Laboratory EMP simulators. The EMP assessment of the advanced fighter aircraft using the F-16 as a test-bed will be completed. The life cycle survivability program for aircraft and missiles involving the Program Offices and the Air Force Logistics Command will continue. Preliminary work in preparation for an EMP assessment of the FB-111 will begin.
3. (U) FY 1982 Planned Program: The total life cycle EMP hardness and hardness assurance program for aircraft and missile systems will continue. Definition of systems upset methodology will be initiated. Alternative S/V assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations can be reduced/eliminated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile systems, and fiber optics system will continue. In the area of system associated structures, testing will be initiated through an iterative process of analysis test, methodology refinement and retest methods will be used to define and verify the final methodology package. An EMP Assessment of the FB-111 will be conducted and a joint Air Force/Defense Nuclear Agency EMP Technology Program will be established.
4. (U) FY 1983 Planned Program: The total life cycle EMP hardness and hardness assurance program for aircraft and missile system will continue. The systems upset methodology scheduled for initiation in FY 1982 will continue. Alternative S/V assessment methodologies will be developed and compared to the current methodology to see if their inherent limitations can be reduced/eliminated. The hardness maintenance/surveillance test methodology required to assure continued system effectiveness will continue to be developed and/or refined. In-house support of EMP testing of aircraft/missile system, and fiber optics systems will continue. Testing of the HAMS system will be initiated. In the area of system associated structures, testing using an interactive process of analysis, test, methodology refinement and retest will continue.
5. (U) Program to Completion: Not Applicable.
6. (U) Milestones: Not Applicable.

Project: #3763

Program Element: #64711F

DOD Mission Area: Airborne Strike, #113

Title: S/V Assessment of Aerospace Systems

Title: Systems Survivability (Nuclear Effects)

Budget Activity: Strategic Programs #3

7. (U) Resources:

PROJECT 3763-S/V Assessment of
Aerospace Systems

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Estimated Costs</u>
	9,400	8,780	6,100	6,800	Continuing	N/A
RDT&E	9,600	8,900	6,600		Continuing	N/A

8. (U) Comparison with FY 1980 Budget Data:

FY 1982 funding changes due to earlier completion of F-16 EMP Assessment/Hardening Program.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64758F

DOD Mission Area: Airborne Strike, #113

Title: B-52 Companion Trainer Aircraft

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Approved	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimate Costs
	TOTAL FOR PROGRAM ELEMENT		12,373	21,100	TBD	---	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Companion Trainer Aircraft addresses the need to maintain a high degree of combat readiness and to enhance in-flight training for Strategic Air Command's combat crew force as military flying becomes increasingly expensive due to rising fuel cost. The Companion Trainer Aircraft is a United States Air Force initiative to investigate the use of an off-the-shelf, low cost modified business jet to provide B-52 aircrews with real in-flight training in basic airmanship, navigation, crew coordination, and primary mission tasks. This training would be conducted at a much lower cost (fuel, operations and maintenance) than actual B-52 operations; potential savings of 100 million gallons of fuel per year is possible. This program would also contribute to extending the service life of the aging B-52 aircraft.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Based on preliminary investigations and anticipating the use of an off-the-shelf airframe. Two CT-39B aircraft will be minimally modified with navigation, radar navigation and electronic warfare suites in FY 1981 to initiate the concept validation test. An interim test report, available in September 1981, is intended to build Congressional confidence in the program and gain approval to proceed into Full Scale Development. The FY 1982 program will purchase aircraft and begin research, development, test and evaluation efforts by beginning advanced design engineering for the complete Companion Trainer Aircraft system. Further the FY 1982 program will conclude the Concept Test started in 1981. A final report will be published in the first Quarter of FY 1982.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Approved	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E (Aircraft)	15,100	3,047	---	---	18,147
Procurement (Aircraft) (PE #11814F)		157,700	---	148,100	305,800

(U) OTHER APPROPRIATION FUNDS:

| Procurement (Aircraft) (PE 11814F)

3,900

TBD

TBD

TBD

Program Element: #64758F

DOD Mission Area: Airborne Strike, #113

Title: B-52 Companion Trainer Aircraft
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Maintaining combat readiness of the strategic air attack force is required to insure a viable deterrent for the free world. The aircrews who provide the combat capability of the United States strategic attack forces must be capable of responding to a variety of employment tasks. This capability, in part relies upon intensive, quality, and recurring aircrew training. The B-52, a product of technology from the 1950s, is powered by engines which use excessive fuel as compared to the significantly efficient engines used on the modern aircraft of today. A national mandate for efficient energy management drives the requirement to examine alternate methods of accomplishing in-flight training. Additionally, the level of flying experience of Strategic Air Command's current combat crew force is less than the level of flying experience for the Strategic Air Command aircrews of the late 1960s and early 1970s. This experience loss cannot be overcome with continued reductions in the amount of total flying time available. The B-52 Weapon System Trainer, a flight simulator now within the procurement cycle, will provide aircrews a capability for concentrated aircrew training in an academically controlled environment. The Weapon System Trainer, however, can never totally replace the need for actual in-flight experience. Therefore, training and significant savings could be realized and the Companion Trainer Aircraft concept should be aggressively pursued. The Companion Trainer Aircraft will permit continued in-flight experience; reduce a possible over-reliance on simulators; increase aircrew morale; and still maintain combat readiness at a significantly lower cost.

(U) RELATED ACTIVITIES: Program Element #64758F will lead into production within Program Element #11814F Companion Trainer Aircraft. Air Training Command is investigating a dual-track training system that will require an additional training aircraft, the Tanker-Transport-Bomber Trainer. The operational life of Military Air Command's T-39 fleet is expected to expire in the late 1980s. The performance requirements for both these potential programs closely match those of the Companion Trainer Aircraft. The advantages of Operational Support Aircraft (T-39 replacement), Tanker-Transport-Bomber Trainer, and Companion Trainer Aircraft commonality will be considered as the programs are initiated. In the Mission Element Need Statement we will address the potential for commonality and identify the combined Milestone I/II decision point as the most appropriate time for program combination. This approach will maximize potential for commonality while, at the same time, preserve the integrity of the individual requirements.

(U) WORK PERFORMED BY: The Companion Trainer Aircraft test program will be managed by Air Force Systems Command Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. The Operational Utility Evaluation will be performed by Air Force Test and Evaluation Center, with the assistance of Strategic Air Command, and Air Force Human Resources Laboratory personnel, using two contractor furnished minimally modified aircraft. The Developmental Test and Evaluation phase will be conducted at Edwards Air Force Base by The Air Force Flight Test Center, The Aeronautical Systems Division, Strategic Air Command, and the development contractor using a full mission capable aircraft. Air Force Test and Evaluation Center will manage the Operational Test and Evaluation portion of this combined test which will assess the operational suitability and effectiveness of the Companion Trainer Aircraft. The major contractors expected to reply to the Request for Proposal are: Boeing Military Airplane Company, Gates-Learjet Corporation, Rockwell International, Cessna Aircraft Company, Lockheed Aircraft, Beech Aircraft Corporation, Grumman Aerospace Corporation, British Aerospace, Inc., Canadair, Inc., Falcon Jet Corporation, Israel Aircraft Industries, Mitsubishi Aircraft International, Inc.

Program Element: #64758F

DOD Mission Area: Airborne Strike, #113

Title: B-52 Companion Trainer Aircraft
Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Strategic Air Command Statement of Need for Companion Trainer Aircraft has been validated by the Requirements Review Group and Air Force Systems Command has designated a Program Office at The Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. A Draft Request For Proposal was released in September 1980 and the Formal Request For Proposal is expected in May 1981.
2. (U) FY 1981 Program: A Request for Proposal to industry will be released in May 1981. The funding in fiscal year 1981 will be used to modify two Air Force T-39B aircraft and start a Concept Validation Test. The test phase includes crew training and performance baseline establishment and the actual evaluation starting in May 1981 and continuing through the first quarter of Fiscal Year 1982.
3. (U) FY 1982 Planned Program: The Concept Test and Evaluation conducted by Air Force Test and Evaluation Center, Air Force Systems Command, and Strategic Air Command will be completed FY 1982. Source Selection will be accomplished in the first quarter of FY 1982 leading to Developmental Test and Evaluation starting in the third quarter of Fiscal Year 1982. Crew station development and integration will be initiated in conjunction with Full Scale Development.
4. (U) FY 1983 Planned Program: When funds become available the contractor will complete the integration effort for specific crew equipment to support navigation, radar navigation and electronic warfare officers. The estimated start date for Developmental Test and Evaluation is December 1983. Estimate production of fully mission capable aircraft will start in Fiscal Year 1983.
5. (U) Program to Completion: The Developmental Test and Evaluation started in December 1983 will continue through September 1984. This effort will support a September 1984 Initial Operational Capability. Production of fully mission capable Companion Trainer Aircraft begun in 1983 will continue through 1985 at a rate of approximately 20 aircraft per year. All Companion Trainer Aircraft would be delivered prior to the end of 1986. The fiscal year 1981 through fiscal year 1984 programs are based upon the Air Force Systems Command schedule estimates. Industry may, in their response to the formal Request for Proposal, support a more expeditious schedule (i.e., development/delivery) than indicated in the planned program of this summary. The difference in program scope from FY 1981 Descriptive Summary and FY 1982 Descriptive Summary is due to program restructuring and the Concept Testing recommended by Congress.

Program Element: #64758F

DOD Mission Area: Airborne Strike, #113

Title: B-52 Companion Trainer Aircraft
Budget Activity: Strategic Programs, #3

6. (U) Milestones:

<u>EVENT</u>	<u>DATE</u>
SAC Statement of Need	September 1979
CTA included in President's Budget 1981	November 1979
SAC Concept of Operation	January 1980
AFSC/ASD Preliminary Program Plan	April 1980
SAC Maintenance Concept	April 1980
Draft Request For Proposal	September 1980
Source Selection Plan	December 1980
Approve DAF	April 1981
Request For Proposal	May 1981
AFSC/AFTEC/SAC Concept Test	May 1981
Source Selection (Milestone I/II)	March 1982
Production Decision (Milestone III)	July 1983
DT&E/IOT&E Start	September 1983
Initial Operational Capability	December 1984
Delivery Complete	December 1986

(U) MISSION ELEMENT NEEDS STATEMENT STATUS: The Mission Element Need Statement has been forwarded from the Air Force to the Office of the Secretary of Defense (OSD) for approval.

(U) EXPLANATION OF MILESTONE CHANGES:

(U) Major restructuring of the funding for fiscal year 1982, will purchase aircraft for using Research Development Test and Evaluation. Milestone III (production decision) is now scheduled for 1983.

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Companion Trainer Aircraft test program will be managed by Air Force Systems Command/ Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio. The Companion Trainer Aircraft program test requirements are divided into two categories: first, a Operational Utility Evaluation of the Companion Trainer Aircraft concept, and second, Developmental Test and Evaluation of the aircraft and the to be developed crew stations. The Companion Trainer Aircraft is a new program, and no testing has been accomplished to date.

(U) The Operational Utility Evaluation will be performed by Aeronautical Systems Division, 4950th Flight Test Squadron, with the assistance of Air Force Test and Evaluation Center, Strategic Air Command, Air Force Human Resources Laboratory personnel. Two minimally modified Air Force CT-39 assets will be used to test the concept. The test will identify any potential problem areas associated with dual qualification of crew members, estimate the training capabilities of the Companion Trainer Aircraft and assess the effects of the Companion Trainer Aircraft on aircrew morale. The Test phase includes time for crew training and performance baseline establishment prior to a formal start date of May 1981. The actual evaluation calls for an interim report to Congress in September 1981 and continuing through April 1982, if required. A final report will be issued two months following test completion.

(U) Development and operational testing will be conducted in a combined DT&E/IOT&E. The Developmental Test and Evaluation will be conducted at Edwards Air Force Base by Air Force Flight Test Center, Aeronautical Systems Division, Strategic Air Command, and the development contractor using a full mission capable aircraft. Major test areas are flying qualities/performance verification and subsystem tests. To determine structural adequacy of the selected airframe/engine these tests will be programmed as required: flight loads survey, fatigue article test, and engine accelerated mission test.

(U) The performance requirements of the airframe/engines and crew stations are listed in the Companion Trainer Aircraft System Specification. The actual aircraft performance will be determined by the selection of the best suited commercially available aircraft. Specific objectives of the Crew Stations which will be demonstrated by tests are training fidelity, equipment reliability, equipment availability and maintainability. No testing has yet been accomplished.

2. (U) Operational Test and Evaluation: Air Force Test and Evaluation Center will manage the Operational Test and Evaluation portion of this combined test which will assess the operational suitability and effectiveness of the Companion Trainer Aircraft. The Companion Trainer Aircraft is proposed to be a contractor maintained system at all levels of maintenance. Therefore, the operational suitability evaluation will primarily address the availability and reliability of the Companion Trainer Aircraft. The purported fuel efficiency will also be assessed. An evaluation will be conducted on the contractor's maintainability and logistics supportability approach (e.g., spares, training, technical orders, support equipment, software,). Estimated start date for Developmental Test and Evaluation is December 1983 continuing through July 1984, this should support a fourth quarter 1984 Initial Operational Capability.

3. (U) System Characteristics: The significant performance parameters that will allow the Companion Trainer Aircraft to support training in B-52 mission task are shown below.

SPECIFIC PERFORMANCE REQUIREMENTS

Aircraft, general:

Jet/multi-engine

Endurance:

3 to 4 hour Training Mission

1 to 2 hour Low Level Profile

Weight/Volume capability that will allow five individuals with flight gear, all necessary subsystems, and fuel to meet mission requirements.

Cabin pressurized to commercial standards.

(470)

470

120

Flight Characteristics/Controls:

Yoke forces similar to the B-52 at low level flight condition.
Yoke configuration/center throttle quadrant.
Stressed for low altitude/high speed flight.
300-350 knots sustained.
Bird resistant windscreens at maximum low level speed.

Powerplant:

State-of-the-art, fuel efficient, fan jet Maximum runway requirement:
7,000 feet Standard day.
Federal Aviation Agency single engine performance certified.

Modifications include:

- Pilot and copilot instrumentation similar arrangement to B-52.
- Functioning navigator/radar navigator station.
- Functioning electronic warfare operators suite.

Reliability/Availability/Maintainability: To be specified in the Request For Proposals and addressed in the offeror's response.

(1171)
(472P)
421 471-472A

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	94,300	120,465	141,100	111,100	Continuing	Not Applicable
2405	Strategic Avionics Crewstation Design Evaluation Facility	500	1,800	4,600	2,600	Continuing	Not Applicable
2406	B-52 Offensive Avionics System	55,000	45,000	21,900			204,000
2548	Nuclear Hardness Study/Electro Magnetic Pulse	16,000	22,565	26,600	13,600		83,865
2570	Electronic System Test Set	11,500	19,100	8,700			64,800
2571	B-52 Aircraft Modernization Program	2,400	6,200	23,500	27,300	Continuing	Not Applicable
2601	B-52 Strategic Radar	1,500	6,100	21,200	20,000	16,600	65,400
2632	Offensive Avionics System/Cruise Missile Integration Weapon						
2633	System Trainer Modification	5,900	7,200	2,400			15,500
2691	B-52H Cruise Missile Integration			15,000	31,900		46,900
2692	Blast/Thermal Evaluation	1,500					1,500
XXXX	B-52 Autopilot		12,500	16,600	15,700		44,800
	B-52H Strategic Projection Force			600			600

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of the B-52 Squadrons development program is to maintain the operational effectiveness of the B-52 force. All models of the B-52 require some modernization to maintain their deterrent capability. Investments are necessary to increase force effectiveness, to provide option flexibility, and to reduce support costs. The aircraft themselves remain structurally sound; however, most B-52 aircraft subsystems are becoming difficult to support due to their age. Regardless of the outyear B-52 missions, the aircraft require updating to provide a supportable operational platform.

(U) BASIS FOR FY 1982 RDT&E REQUEST: During fiscal year 1982, this program element has nine critical projects in progress. Eight of the projects are on-going, on-contract projects. Three are completed in fiscal year 1982. One is a new start. The Offensive Avionics System project completes this year with flight testing and missile launches. The

Program Element: #111113

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

other two projects to complete this year include one which provides cruise missile support equipment and another which modifies crew trainers to include the cruise missile capability. The aircraft modernization program and related projects to update B-52 radar systems and autopilots are all three on contract and proceeding toward modification initiation. The one new start is the B-52H cruise missile integration which will provide an option to deploy additional cruise missiles. The individual project cost estimates are based on contractual and schedule requirements.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion Continuing	Total Estimated Costs
EDT&E	94,300	118,500	107,500			
Procurement 3010 *	451,600	419,200	345,500		926,300	2,254,700
3400	3,100	34,100	41,500		229,600	301,300

(U) OTHER APPROPRIATION FUNDS:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
Procurement 3010 *	451,600	437,300	331,500	461,000	743,000	2,625,300
3400	3,100	34,100	44,100	66,500	251,700	399,500

Cruise Missile Carriage, B-52G (Mod #3022):

Procurement (3010)*	82,000	116,700	115,400	168,300	432,000	957,200
(Quantity)	(22)	(40)	(40)	(41)	(198)	(344)
Operation and Maintenance/Installation (3400/540)		1,000	3,100	4,700	62,000	70,800
(Input)		(2)	(29)	(40)	(273)	(344)
(Output)		(1)	(13)	(40)	(290)	(344)

Offensive Avionics System, B-52G/H (Mod #3023):

Procurement (3010)*	340,700	290,600	204,300	213,800	162,000	1282,800
(Quantity)	(31)	(64)	(61)	(64)	(43)	(268)
Operation and Maintenance/Installation (3400/540)	3,100	31,900	35,700	48,400	105,300	224,400
(Input)		(4)	(42)	(62)	(160)	(268)
(Output)		(2)	(16)	(65)	(185)	(268)

*Includes Initial Spares

Program Element: #11113P
 DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
 Budget Activity: Strategic Programs, #3

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
<u>Observable Differences/Functionally Related</u>						
<u>Observable Differences, B-52G (Mod #3041):</u>						
Procurement (3010)* (Quantity) Operation and Maintenance/Installation (3400/540) (Input) (Output)	28,900 (24)	10,000 (40) 1,200 (2) (1)	5,500 (40) 5,300 (29) (13)	4,600 (41) 7,800 (40) (40)	3,200 (27) 23,200 (273) (118)	52,400 (172) 37,500 (172) (172)
<u>B-52D Autopilot, B-52D (Mod #18420B):</u>						
Procurement (3010)* (Quantity) Operation and Maintenance/Installation (3400/540) (Input) (Output)		6,300 (16)	8,000 (19)	.100	26,100 (44) 2,600 (79) (79)	42,300 (79) 2,700 (79) (79)
<u>B-52G/H Electromagnetic Pulse:</u>						
Procurement (3010)* (Quantity) Operation and Maintenance/Installation (3400/540) (Input) (Output)	20,000 (15)		66,300 (62)		119,700 (124) 58,600 (239) (253)	288,600 (268) 64,100 (268) (268)

*Includes Initial Spares

Program Element: #111137
 DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons
 Budget Activity: Strategic Programs, #3

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
<u>Aircraft Modernization Program</u>						
<u>Fuel Quantity Indicator System Update</u>						
<u>Environmental Control System Update:</u>						
Procurement (3010)* (Quantity) Operation and Maintenance/Installation (3400/540) (Input) (Output)			36,500 (5)	TBD	TBD	TBD (536)
					TBD (536) (536)	TBD (536) (536)
<u>B-52H Strategic Projection Force</u>						
<u>External and Internal Carriage Increases:</u>						
Procurement (3010)* (Quantity) Operation and Maintenance/Installation (3400/540) (Input) (Output)		2,000 (35)	23,900 (25)	15,300 (10)		41,200 (70)
			1,200 (35) (35)		10,000 (35) (35)	11,200 (70) (70)

* Includes Initial Spares

Program Element: #11117

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

3) DETAILED BACKGROUND AND DESCRIPTION: Cruise missiles will become an important element of the air-breathing leg of the strategic TRIAD and an adequate carrier for these missiles must be provided. The nation is now committed to employ the B-52 as the first cruise missile carrier aircraft and the Air Force, at this time, believes that with reasonable improvements in maintainability, reliability, nuclear hardness, and selected avionics upgrades, the B-52G/H should serve as an effective and economical cruise missile carrier into the 1990s. The purpose of this program element is to develop the B-52 cruise missile carrier modifications and to evaluate and develop the weapon system upgrades necessary for maintaining the viability of the B-52 weapon system throughout the coming decade. The first priority is to upgrade the B-52G/H bombing navigation system and to integrate this upgraded system with the electronics and carriage gear required to carry and launch cruise missiles. The B-52 Offensive Avionics System program, formerly called the B-52 Avionics Update - Phase One, provides for the full scale engineering development of the necessary improvements to the bombing navigation system and will lower present avionics system support costs through replacement of selected components with components of improved reliability and maintainability. Other major program efforts will provide for improved flight safety, assess the current nuclear hardness of the aircraft and identify changes to improve hardness, develop an improved radar update, and develop an Electronics System Test Set to support the Air Launched Cruise Missile and Short Range Attack Missile. The program also provides for modification of the B-52 Weapon System Trainer to incorporate avionics updates and cruise missile integration changes.

Thus, the Avionics Update - Phase Two Project which was to have provided this capability has been restructured and renamed the Aircraft Modernization Program. This restructured program will improve B-52 reliability and maintainability and support use of the aircraft as a cruise missile carrier into the 1990s.

(U) Each of the projects under this program is described below. A more complete description of each of the major projects is provided on separate descriptive summaries which are attached.

(U) The Strategic Avionics Crewstation Design Evaluation Facility ground tests new avionics systems required by Strategic Air Command and accomplishes human engineering studies prior to avionics flight testing. Subtasks include ground checkout of systems with Strategic Air Command crewmembers prior to flight test programs. This is a continuing project.

(U) The B-52 Offensive Avionics System Project will provide an offensive avionics update package for the B-52G/H. This update responds to a 1975 Strategic Air Command requirement to increase aircraft effectiveness and reduce support costs. The present bombing navigation system is 1950 analog technology and is clearly becoming less reliable, less effective, and more costly to maintain. This project also responds to the immediate needs to integrate with the cruise missile program, develop support equipment, and accelerate delivery of the first operational aircraft.

The B-52 Nuclear Hardness Study/Electromagnetic Pulse project will improve the survivability and vulnerability of the B-52 aircraft to nuclear effects. The first phase of the study laid out program needs. The second phase, which consisted mostly of testing on the test facilities and dipole site, identified:

A modification to the B-52G/H aircraft for this protection begins in fiscal year 1981. This modification was built on the analyzing and testing on the basic aircraft systems for blast, thermal, and electromagnetic pulse hardness which took place in 1980 and 1981. The continuing testing and analyses will develop and verify the nuclear hardened baseline design for the entire B-52G/H

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

weapon system for nuclear blast/thermal/electromagnetic pulse weapon effects, evaluate alternative approaches for hardening, and further examine the needs for additional protection. In addition, the project will test the offensive avionics system and cruise missile carriage modified aircraft with and without the electromagnetic pulse protection kit, support a technology base effort, and establish protocol/criteria for evaluation purposes. These expansions and increased research, development, test and evaluation investment were recommended by the Defense Science Board in studies during 1979 through 1981. The project will develop electromagnetic pulse fires for modification of critical aircraft systems that support launch and release of weapons, but not included in Offensive Avionics System and Air Launched Cruise Missile updates.

(U) The Electronics System Test Set project provides for the design and development of the necessary support equipment to checkout the Air Launched Cruise Missile and the Short Range Attack Missile as well as the missile interface units from the B-52 Offensive Avionics System program. The project was initiated under the Short Range Attack Missile B program and was transferred when that weapon program was terminated. The Electronic System Test Set will provide maintenance analysis and test capability for the B-52/cruise missile weapon system in time to meet Offensive Avionics System/Air Launched Cruise Missile initial Strategic Air Command alert aircraft capability in September 1981.

The B-52 Aircraft Modernization Program is a completely restructured and revised program formerly called Offensive Avionics System - Phase Two. It now focuses on two primary objectives. The first supports the transition of the B-52G/H force

to maintain aircraft operationally effective. The second purpose is to ensure the force remains supportable through its predicted extended life into the next century. Analyses have been completed in fiscal year 1980 to identify potential problem areas in essential systems. A Full Scale Engineering and Development contract is scheduled for release in the second quarter of fiscal year 1981. The shift of outyear mission requirements provided by Headquarters Strategic Air Command and future aircraft problem predictions provided by Headquarters Air Force Logistics Command have been incorporated into the definition and scope of this program. The project will coordinate planning, definition, integration, and eventual flight testing of the overall aircraft modernization.

The B-52 Strategic Radar project is a reconstructed effort from what was formerly known as the Electronically Agile Radar project.

the requirement for a forward looking radar as sophisticated as the Electronically Agile Radar was eliminated. Therefore, the project will provide a critically needed radar update which is significantly less complex than the original program but which is suitable for solving the serious maintainability, reliability and supportability problems with the current aging system and for enabling the B-52 to perform the mix of penetration and standoff missions envisioned for the 1980s.

(U) Offensive Avionics System/Cruise Missile Integration Weapon System Trainer Modification provides the necessary development engineering to ensure that the B-52 Weapon System Trainer under development by the Simulator System Project Office is compatible with the modification efforts resulting from the Offensive Avionics System and cruise missile programs.

(U) The B-52H Cruise Missile Integration project will begin in fiscal year 1982. This is a follow-on effort to protect the option for B-52H employment with cruise missiles. Current efforts, prior to fiscal year 1982 are aimed only at the B-52G.

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

- (U) Autopilot project started in fiscal year 1981 and is a two year effort. Activities include design, fabrication, and integration of a new flight control system and a new heading system for the B-52D aircraft. These updates are required to replace current systems having supportability and safety of flight problems. Due to commonality of aircraft, the output from this project will also provide an improved autopilot for the B-52G/H. B-52D modification begins in fiscal year 1982. B-52G/H modification is scheduled to begin in fiscal year 1983.
- (U) B-52 Strategic Projection Force project will provide an avionics demonstration of a LASER ranger incorporated with offensive avionics system. The purpose of the demo is to determine the increase in accuracy provided by the change. The Strategic Projection Force will provide 35 B-52H aircraft modified for external and internal carriage. If this project demonstrates a substantial reduction in circular error probable, an avionics modification for the force will be considered. The carriage modifications do not require development.
- (U) RELATED ACTIVITIES: The B-52 Squadrons program has received benefits from the Low Life Cycle Cost Avionics (PE 63705F), the Electronically Agile Radar (PE 63241P), the Standard Precision Navigator (PE 64201P), and other similar ongoing Research and Development efforts in Air Force Systems Command, as well as contractor internal research and development efforts. The program will support the B-52 avionics update requirements as stated in Strategic Air Command Required Operational Capabilities 6-75 and 12-76. The cruise missile development program will be integrated with the offensive avionics update projects in this program element.
- (U) WORK PERFORMED BY: The original avionics study which identified avionic subsystems requiring upgrading under this program was accomplished by Boeing Military Airplane Company. The development program has been awarded to them on a sole source basis. The major subsystems/subcontractors were selected by Boeing Military Airplane Company with Air Force approval. The list of contractors is as follows:
- | | |
|---|--|
| Prime Contractor: | Product: |
| Boeing Military Airplane Company, Wichita, Kansas | Offensive Avionics System |
| <u>Major Subcontractors for Offensive Avionics System</u> | |
| Lear Siegler, Grand Rapids, Michigan | Attitude and Heading Reference System |
| Sperry Flight Systems, Phoenix, Arizona | Controls/Displays |
| International Business Machine,
Owego, New York | Processor |
| Norden, Norwalk, Connecticut | Radar Modification |
| Honeywell, Minneapolis, Minnesota | Radar Altimeter |
| Honeywell, St. Petersburg, Florida | Inertial Navigation Set |
| Softech, Waltham, Massachusetts | Jovial 3B Compiler |
| Sundstrand, Redmond, Washington | Data Transfer Unit, Data Transport Devices |
| Teledyne - Ryan, San Diego, California | Doppler Velocity Sensor |

~~Program Element:~~ #111137

~~Base Station Area:~~ 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs #3

~~Associate Contractors on Offensive Avionics System~~
~~(through the Joint Cruise Missile Program Office)~~

General Dynamics, San Diego, California
Barnesell Douglas, St. Louis, Missouri
Boeing Aerospace Co, Seattle, Washington

Air-to-Ground Missile-109 Cruise Missile
Air-to-Ground Missile-109 Cruise Missile Software
Air-to-Ground Missile-86 Cruise Missile

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The major focus of the fiscal year 1976 program was to study numerous alternative update systems, packages, and approaches for updating the B-52 offensive avionics system. The study was completed, the update system was defined, and both Headquarters Air Force and the Office of the Secretary of Defense gave their approval. The doppler program started a Research, Development, Test and Evaluation effort to develop a nuclear hardened doppler velocity sensor for strategic bomber application. The Strategic Avionics Crewstation Design and Evaluation Facility was converted and secured for program support. The B-52 Antiship Capability Study was completed and the Guided Bomb Unit-15 integration was tasked to the Guided Bomb Unit-15 program element.

(U) The 1977 program finalized the development contract for the B-52 Offensive Avionics System development effort. This represented the first major offensive avionics update approved for the B-52 and therefore it required a careful definition in concert with expected future missions. The doppler project completed source selection and two contractors were selected for the flight test/flyoff phase along with survivability analysis tests to be conducted by the Air Force Weapons Laboratory. The Strategic Avionics Crewstation Design and Evaluation Facility completed crewmember tests and evaluations to establish a baseline of present capabilities against which to design/evaluate future changes.

(U) In 1978, the Common Strategic Doppler contractors submitted doppler radar sets for a flight test evaluation and competition. The winner was Teledyne Ryan. The Strategic Avionics Crewstation Design and Evaluation Facility established the baseline of present avionics for comparisons and assisted in the planning of effective controls and displays. The B-52 Offensive Avionics System project, formerly known as the B-52 Avionics Update - Phase One, was accelerated one year with funds from the fiscal year 1978 Supplemental Budget. The program completed a Systems Requirement Review, contractor awards were made, and software development was initiated. The total Offensive Avionics System research, development, test and evaluation contract was signed. The studies for B-52 life extension and nuclear hardness were initiated. The Electronic System Test Set development was continued. No efforts were accomplished in fiscal year 1978 on a B-52 Avionics Update - Phase Two program which was planned as a follow-on to the Offensive Avionics System Phase One program.

(U) In 1979, the Common Strategic Doppler project was completed and efforts were initiated to integrate the modification on the C/IC-135 force and to integrate the hardened sensor into B-52G/H Offensive Avionics System. The Strategic Avionics Crewstation Design Evaluation Facility completed human engineering testing with B-52 crewmembers on the B-52 Offensive Avionics System project package prior to flight testing. Under the Offensive Avionics System

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

project, subsystem deliveries were received for integration into the Offensive Avionics System package, fabrication of the system integration laboratory and test facility was begun, and testing efforts were initiated. Long lead procurement funding was released for cruise missile external pylons. The Avionics Update Phase Two project, now restructured and renamed the B-52 Aircraft Modernization Program, began in fiscal year 1979 with trade studies, system definition, and initial system design. Efforts identified in the Life Extension Study which required development or prototyping were included. The Nuclear Hardness Study was completed. These results will be used to develop and verify a hardness baseline for nuclear blast/vulnerability assessments for the B-52G/H system. The Electronic System Test Set project continued development. The observable differences/functionally related differences development project was initiated and completed.

In 1980 the Offensive Avionics System program production decision and contract actions were completed in the fourth quarter of fiscal year 1979. The Offensive Avionics System efforts in research, development, test and evaluation include completing software development and system integration laboratory and test facility integration. The flight test aircraft (B-52G) modification began flight testing in September 1980. The combined developmental test and evaluation and initial operational test and evaluation is scheduled from September 1980 through fiscal year 1981. The Nuclear Hardness Study/Electromagnetic Pulse project began testing of a B-52G on Trestle. The tests show that aircraft Electromagnetic Pulse mods are required. They will be developed and then produced and installed beginning in fiscal year 1981. The Electronic System Test Set project continued development of the support equipment. Fiscal year 1980 was the second year of efforts on the B-52 Aircraft Modernization Program. The outyear B-52 modernization efforts were completely revised in 1980. Under this effort changes have been identified to provide for sustained use of the B-52 as an all standoff cruise missile carriage force into the 1990s.

Crew task loading studies were initiated to determine outyear mission needs due to reduced penetration requirements and the need to reduce support costs. Tasks identified in the fiscal year 1978 Life Extension Study were also included under this project.

the need for a forward looking radar with the full capability of the electronically agile radar were diminished. Therefore, the project was restructured to provide a radar update more suitable to solving growing radar system supportability problems and to meeting outyear B-52 missions requirements. Development of engineering data to incorporate the offensive avionics system/cruise missile integration package into the B-52 Weapon System Trainer was initiated.

2. FY 1981 Program: The combined developmental test and evaluation and initial operational test and evaluation of the Offensive Avionics System began and is scheduled to be completed September 1981. This is the same date for first alert capability of a B-52G with integrated Air Launched Cruise Missile and Offensive Avionics System capability. Modification of both B-52G and H aircraft with the Offensive Avionics System mod package begins this year. Nuclear weapon certification testing begins and will continue into the next year. Combined testing with launches of the Air Launched Cruise Missile and the Short Range Attack Missile take place late in this year. The Strategic Avionics Crewstation Design Evaluation Facility will concentrate on the human engineering aspects of the design and layout of Aircraft Modernization Program efforts, to include pilot compartment evaluations. In the Nuclear Hardness Study/Electromagnetic Pulse project, the development of the modification fixes to provide minimum protection to aircraft systems from the effects of Electromagnetic Pulse will be completed. The scope and definition of this project reflect the expansion recommended by the

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Defense Science Board to provide greater assurance of strategic aircraft survival against the effects of nuclear detonations. A modification will begin this year.

Planning for scheduled outyear testing will be accomplished. The Electronic System Test Set project continued in this year with concentration on development of software and test package sets for the Air Launched Cruise Missile and the Short Range Attack Missile support. In the Aircraft Modernization Program, the full scale engineering and development contract is to be signed. The selected subcontractors are to begin fabrication of subsystems for delivery the following year. Integration and software design is to begin in the laboratory in anticipation of hardware delivery. Final refinements to architecture and interfaces with the B-52 Offensive Avionics System project are scheduled. A new project will be initiated to design, fabricate, integrate, and flight test an automatic flight control and heading system for the B-52D. Because of commonality in all models of the B-52, this project will also provide data for a follow-on autopilot for B-52G/H. The strategic radar project will begin fabrication of the radar hardware and software for eventual input to the Aircraft Modernization Program. In addition, the Offensive Avionics System/Cruise Missile Integration Weapon System Trainer modification package development will continue this year.

3. (U) FY 1982 Planned Program: During this year, the Offensive Avionics System project will be completed and the test aircraft will be transferred to the B-52 Aircraft Modernization Program because aircraft modification for this project begins this year for developmental test and evaluation/initial operational test and evaluation in fiscal year 1983. All electromagnetic pulse, blast, thermal, and related aircraft structural problems should be fully identified and efforts will concentrate on testing the selected aircraft modifications, evaluating alternative approaches for strategic aircraft hardening and further examining the threats and thus the needs for additional protection. A B-52G modified for offensive avionics system and cruise missile carriage will be tested and data will be analyzed for existing levels of protection. The Electronic System Test Set project will be completed this year except for necessary items uncovered during initial operational test and evaluation and early follow-on test and evaluation. This year will be the major investment year for the strategic radar project because of hardware procurement, aircraft integration, and software interfaces. The modification to the weapon system trainer for Offensive Avionics System and Air Launched Cruise Missile will be completed this year. The autopilot project will be completed this year for the B-52D because the B-52D aircraft is going to modification in fiscal year 1982. The B-52G/H data will be integrated for Aircraft Modernization Program flight testing. The Strategic Avionics Crewstation Design Evaluation Facility project will continue during this year. One new start will be initiated - B-52H Cruise Missile Integration. This project protects the option to deploy cruise missiles on the B-52H. These missiles could be either the current Air Launched Cruise Missile or a follow-on generation of cruise missiles.

4. (U) FY 83 Planned Program: During this year the B-52 Aircraft Modernization Program and related Strategic Radar and Autopilot projects continue. All six major subsets of the Aircraft Modernization Program should now be installed on the flight test aircraft and fully involved in a combined development test and evaluation/initial operational test and evaluation program. Initiation of modification efforts on the B-52G/H for modernization subsets which are ready is proposed to begin this year. The remaining subsets would begin the following year in fiscal year 1984. The planned subsets now included in the overall Aircraft Modernization Program are: update to current forward looking radar system (separate project), autopilot (separate project), pilot/copilot controls and displays, forward looking infrared/electro-optical viewing system update, and a replacement fuel quantity indicator system. The continuing strategic avionics crewstation design evaluation facility project will be ground checking man/machine human engineering aspects and training initial crewmembers for flight test program and initial aircraft deployment of aircraft modernization-

Project Element: #11113P

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Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

tion program updates. The project to develop the cruise missile integration interfaces to permit cruise missile carriage for the B-52H is scheduled for completion this year. The development program to provide electromagnetic pulse protection and associated aircraft survivability and vulnerability problems for the B-52G/H is scheduled for completion this year. A B-52G aircraft modified with the offensive avionics system, cruise missile carriage and electromagnetic pulse protection kit will be tested and analyzed this year. Final technology findings and hardness verifications will be made available to adjust ongoing modification program and to provide follow-on strategic bomber efforts an extremely valuable data base.

5. (U) Program to Completion: The modification program for the electromagnetic pulse fixes and associated aircraft survivability and vulnerability problems ends. The B-52 Aircraft Modernization Program continues after a production decision in either late fiscal year 1983 or early fiscal year 1984. Cruise missile carriage modification for the B-52H will be completed. If further cruise missile or weapon system introductions are made, then their integration will be required. The Aircraft Modernization Program will require an update to the Weapon System Trainer system and/or the Companion Trainer Aircraft program. Additional B-52 projects may be required for specialized role and mission conversions.

6. (U) Milestones:

Date

A. B-52 Offensive Avionics Systems (Formerly Avionics Update - Phase One):

- | | |
|--|----------------------------|
| (1) Initial Contract Signed (Studies) | January 1976 |
| (2) Phase 0 Definition Contract Signed | October 1977 |
| (3) Phase 1 Contract | August 1978 |
| (4) Release Long Lead Production Funds for Cruise Missile Pylon | September 1978 |
| (5) Production Decision/Approval | July 1979 |
| (6) Initiation of Developmental Test and Evaluation/Initial Operational Test and Evaluation | September 1980 |
| (7) Completion of Developmental Test and Evaluation/Initial Operational Test and Evaluation | September 1981 |
| (8) First Aircraft - In (Boeing) | December 1980 |
| (9) First Aircraft - Out (Boeing) | June 1981 |
| (10) First Aircraft Delivery to Strategic Air Command | Not Later Than August 1981 |
| (11) First Aircraft - Alert Air Launched Cruise Missile with Offensive Avionics System | September 1981 |
| (12) Initial Operational Capability - B-52G Squadron (16 PAA) with Air Launched Cruise Missile and Offensive Avionics System | December 1982 |

B. B-52 Aircraft Modernization Program (Formerly Avionics Update - Phase Two):

- | | |
|---|---------------------------------|
| (1) Definition/Trade Studies | Fiscal Year 1979/1980 |
| (2) Full Scale Engineering and Development Contract | Second Quarter/Fiscal Year 1981 |
| (3) Prototyping Initiation | Fiscal Year 1982 |
| (4) Production Decision - Partial/Total Package | Fiscal Year 1983/1984 |
| (5) First Aircraft - In/Out | Fiscal Year 1985 |

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

C. Electronic System Test Set:

- (1) Critical Design Review
- (2) First Fabricated Set
- (3) System Software Critical Design Review
- (4) Planned Production Start
- (5) Initial Alert Capability
- (6) Initial Operational Capability

October 1977
October 1977
May 1978
January 1980
September 1981
December 1982

D. Nuclear Hardness Study/Electromagnetic Pulse:

- (1) Start Studies
- (2) Dipole Testing
- (3) Trestle Testing - Basic Aircraft
- (4) Modification Initiation (Tailored Approach) - B-52G/H
- (5) Trestle Testing - Offensive Avionics System/Cruise Missile Carriage Aircraft
- (6) Alternative Approaches Analysis
- (7) Trestle Testing - Offensive Avionics System/Cruise Missile Carriage/Protection Kit Aircraft

Fiscal Year 1978
Fiscal Year 1979
Fiscal Year 1980/1981
Fiscal Year 1981

Fiscal Year 1982
Fiscal Year 1981-1983

Fiscal Year 1983

E. B-52 Strategic Radar:

- (1) Strategic Air Command Required Operational Capability 6-75 Approved
- (2) Initiation of Engineering
- (3) Completion of Advanced Development (PE 63241/PE 11113F)
- (4) Delivery of Research, Development, Test and Evaluation Model
- (5) Start Flight Testing
- (6) Complete Flight Testing

December 1976 (Electronically Agile Radar)
October 1979 (Electronically Agile Radar)
January 1980 (Electronically Agile Radar)
October 1981
January 1983
March 1984

F. B-52H Cruise Missile Integration:

- (1) Full Scale Engineering and Development Contract
- (2) Start Flight Testing
- (3) Complete Flight Testing
- (4) Production Decision
- (5) First Aircraft in for Modification

Fiscal Year 1982
Fiscal Year 1982
Fiscal Year 1983
Fiscal Year 1983
Fiscal Year 1985

Program Element: #11113P

DOD Mission Area: 113, Airborne Strike

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

G. Autopilot:

- (1) Full Scale Engineering and Development Contract
- (2) Production Decision - B-52D
- (3) Start B-52D Modification
- (4) Start B-52G/H Modification

Second Quarter/Fiscal Year 1981
Fiscal Year 1981
Fiscal Year 1982
Fiscal Year 1983

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1981 Budget Data: All significant changes are addressed in the individual project descriptive summaries which are attached.

Project: #2406

Program Element: #1111X

DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The present B-52G/H bombing navigation system and other systems were designed with technologies available in the early 1950s and are experiencing increasing maintenance costs (e.g., the present Mean Time Between Failure of the bombing navigation system in the B-52G/H fleet is _____ hours and the overall reliability is approximately _____). Projected improvements in the enemy defensive threat demand navigation accuracy and target recognition ability.

Of equal importance, a study of avionics systems, completed in October 1976, found that selected offensive avionics system support costs could be reduced if high cost, low reliability components and subsystems identified in the study were exchanged with suggested replacement items. Finally there is the need to modify the B-52G aircraft to be compatible with the carriage and launch of cruise missiles.

(U) The B-52 Offensive Avionics System project, formerly known as the B-52 Avionics Update - Phase One, responds to the immediate need to improve the performance of the B-52G/H bombing navigation system, to reduce avionics system support costs, and to integrate cruise missile carriage on the B-52G. The urgency of the need for improved performance and cruise missile carriage, tempered by the desire to effect significant Operational and Support cost savings shapes the priorities of this project.

(U) The Offensive Avionics System project includes an improved heading system; integrated controls and displays; a reliability modification to the present forward looking radar; a high accuracy inertial navigation system; the addition of digital processing and a new data bus; and a new doppler and radar altimeter. As well as accommodating cruise missile carriage, the new avionics developed under the Offensive Avionics System project will provide stored data and integrated sensor updates to the missiles (Air Launched Cruise Missile and Short Range Attack Missile) prior to launch from the aircraft. Precision initialization is required prior to launch of Air Launched Cruise Missile to insure a high probability of acquiring the first terrain correlation matching guidance update point. Other benefits to the cruise missile are a two-fold increase in system reliability and nuclear hardness to electromagnetic pulse/transient radiation effects on electronics.

(U) The first B-52G upgraded with the integrated Offensive Avionics System package is scheduled to be alert capable with external Air Launched Cruise Missiles in September 1981. The program Initial Operational Capability date, which consists of the first full squadron (16 PAA B-52G) updated with Offensive Avionics System and capable of carrying and launching cruise missiles, is December 1982.

Project: #2406

Program Element: #11113P

DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) RELATED ACTIVITIES: The B-52 Squadrons program benefits from the Low Life Cycle Avionics (PE 63705F), the Electronically Agile Radar (PE 63241P), the Standard Precision Navigator (PE 64201P), and other similar Research and Development efforts in Air Force Systems Command, and contractor internal research and development efforts. The program will support the B-52 avionics update requirements as stated in Strategic Air Command Required Operational Capabilities 6-75 and 12-76. The cruise missile development program will be integrated with the B-52 Offensive Avionics System project.

(U) WORK PERFORMED BY: The avionics study which identified avionic subsystems for incorporation into this program was accomplished by Boeing Military Airplane Company. The development program has been assigned to Boeing Military Airplane Company on a sole source basis. The major subsystems/subcontractors were selected by Boeing Military Airplane Company with Air Force approval. The list of contractors is as follows:

Prime Contractor

Boeing Military Airplane Company, Wichita, Kansas

Major Subcontractors for Offensive Avionics System

Lear Siegler, Grand Rapids, Michigan

Sperry Flight Systems, Phoenix, Arizona

International Business Machine, Owego, New York

Norden, Norwalk, Connecticut

Honeywell, Minneapolis, Minnesota

Honeywell, Saint Petersburg, Florida

Softtech, Waltham, Massachusetts

Sundstrand, Redmond, Washington

Teledyne - Ryan, San Diego, California

Associate Contractors on Offensive Avionics Systems

(Through Joint Cruise Missile Program Office)

General Dynamics, San Diego, California

McDonnell Douglas, Saint Louis, Missouri

Boeing Aerospace Company, Seattle, Washington

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The major effort of the fiscal year 1976 program was to study numerous alternative update systems, packages, and approaches for upgrading the B-52 offensive avionics. The study was completed, the update system was defined, and both Headquarters Air Force and the Office of the Secretary of Defense gave their approval to proceed.

Product

Offensive Avionics System

Attitude and Heading Reference System

Controls/Displays

Processor

Radar Modification

Radar Altimeter

Inertial Navigation Set

Jovial 3B Compiler

Data Transfer Unit

Doppler Velocity Sensor

Air-to-Ground Missile-109 Cruise Missile

Air-to-Ground Missile-109 Cruise Missile Software

Air-to-Ground Missile-86 Cruise Missile

Project: #2406

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) The 1977 program finalized the Research, Development, Test and Evaluation contract for the B-52 Offensive Avionics System project development. This represented the first major offensive avionics update approved for the B-52 and required a careful definition in concert with expected future missions.

(U) In 1978, the B-52 Offensive Avionics System project, known then as the B-52 Avionics Update - Phase One, was accelerated one year with funds from the fiscal year 1978 Supplemental Budget. The program completed a System Requirements Review, contractor awards were made, and software development was initiated. Total Phase One Research, Development, Test and Evaluation contract was signed in August 1978.

(U) In 1979, the hardened sensor developed under the Common Strategic Doppler project was completed (this sensor will be integrated into B-52G/H under the Offensive Avionics System project). Deliveries were received for integration into the Offensive Avionics System package, fabrication of the system integration laboratory and test facility was begun, and testing efforts were initiated. Long lead procurement funding will be released during fiscal year 1979 for cruise missile external pylons to meet the programmed September 1981 initial alert requirement.

(U) In fiscal year 1980, the Offensive Avionics System program production decision and appropriate related contract actions occurred in the fourth quarter of fiscal year 1979. The efforts in Research, Development, Test and Evaluation included completing software development and system integration laboratory and test facility integration. The flight test aircraft (B-52G) modifications completed this year with flight testing starting in September 1980. The combined developmental test and evaluation and initial operational test and evaluation is scheduled from September 1980 through fiscal year 1981.

2. (U) FY 1981 Program: Flight testing is the main task for this year. Both testing of the Offensive Avionics System and then integration with the Air Launched Cruise Missile and Short Range Attack Missile will take place. In fiscal year 1981, the combined developmental test and evaluation and initial operational test and evaluation of the Offensive Avionics System is scheduled to be completed in September 1981. This is the same date for first alert capability of a B-52G with integrated Air Launched Cruise Missile and Offensive Avionics System capability. Modification of both B-52G and H aircraft to incorporate the Offensive Avionics System will begin this year.

3. (U) FY 1982 Planned Program: Flight testing is scheduled for completion during this year. If the Air Launched Cruise Missile program slips, some flight testing may extend into this year. Flight testing for the first quarter (October through December) has already been scheduled. The Offensive Avionics System update testing will complete in FY 1982 with nuclear weapons certification and the test aircraft will transition to the B-52 Aircraft Modernization Program.

4. (U) FY 1983 Planned Program: Not Applicable.

5. (U) Program to Completion: Not Applicable.

Project: #2406

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Offensive Avionics System
Title: B-52 Squadrons
Budget Activity: Strategic Programs, #3

6. (U) Milestones:

- A. Initial Contract Signed (Studies)
- B. Phase 0 Definition Contract Signed
- C. Phase I Contract
- D. Release Long Lead Production Funds for Cruise Missile Pylon
- E. Initiation of Development, Test and Evaluation/
Initial Operational Test and Evaluation
- F. Completion of Development, Test and Evaluation/
Initial Operational Test and Evaluation
- G. Production Decision/Approval
- H. First Aircraft - In (Boeing)
- I. First Aircraft - Out (Boeing)
- J. First Aircraft Delivery to Strategic Air Command
- K. First Aircraft - Alert Air Launched Cruise Missile with
Offensive Avionics System
- L. Initial Operational Capability - B-52G Squadron (16 PAA) with
Air Launched Cruise Missile and Offensive Avionics System

Date
January 1976
October 1977
August 1978
September 1978

June 1980

September 1981
July 1979
December 1980
June 1981
Not Later Than August 1981

September 1981
December 1982

7. (U) Resources (\$ in thousands):

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	55,000	45,000	21,900	386,700	597,200	204,000
Procurement	451,600	417,300	325,200	60,900	190,500	2,292,400
	3,100	34,100	44,100			332,700

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	55,000	45,000	3,700			185,800
Procurement	451,600	419,200	331,500		900,500	2,214,900
	3,100	34,100	41,500		227,500	299,200

(U) The increase in fiscal year 1982 development funding was required to extend the flight test program for three months, October 1981 through December 1981, to complete combined offensive avionics system, air launched cruise missile, and short range attack missile testing. The extension is felt to be required prior to turning over the aircraft and new systems to the Strategic Air Command for follow-on test and evaluation. The increase in procurement funding is due to inflation and cost increases within the present program.

Budget Activity: Strategic Programs #3

Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Offensive Avionics System test program will be a combined Development Test and Evaluation/ Initial Operational Test and Evaluation effort extending for 15 months. The flight testing portion begins in September 1980 with completion scheduled for December 1981. The flight test program will definitely extend for 15 months with an additional follow-on 12 months possible to complete the operational command checkout for Strategic Air Command.

(U) The objective of the B-52 Offensive Avionics System program is to test and evaluate the operational effectiveness and operational suitability of the selected Offensive Avionics System package including the integration of the Air Launched Cruise Missile and Short Range Attack Missile. The test environment will represent the actual combat conditions as close as possible using a modified B-52G. Operational deficiencies will be identified and changes/tradeoffs will be recommended. Information will be provided for refining training concepts, refining tactics, techniques and doctrine, updating publications, and refining operating and support cost estimates.

(U) The test team crewmembers will be drawn from the mainstream of the Strategic Air Command crew force in order to provide a more realistic appraisal of the new equipment.

(U) The program provides an update to the B-52G/H offensive avionics package. The effort will include design, fabrication, and integration of an offensive avionics system for a flight test evaluation program leading to a Class V modification to the B-52G/H fleet.

(U) The new avionics systems will include as a minimum, but not be limited to, the addition and/or modification of the following systems/capabilities:

- a. (U) Attitude and heading reference system - Replace present heading and attitude systems with a more reliable, accurate system.
- b. (U) Radar altimeter - Replace radar altimeter with a more reliable system capable of performing terrain correlation.
- c. (U) Digital processor(s) - Replace present analog bombing navigation system computers providing bombing, navigation, and air launched missile computations.

Budget Activity: Strategic Programs #3

Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

d. (U) Military-Standard-1553A Data Bus - Insures resultant system architecture will meet Air Force digital time division multiplex standard.

e. (U) Controls and displays - Provide necessary controls and displays to ensure proper man/machine interface.

f. (U) Doppler Velocity Sensor - Replace present APN-89A Doppler radar with the common strategic doppler.

g. (U) Mapping radar modification - Modify the present radar system to improve performance, reliability, and maintainability.

h. (U) Inertial navigation capability - Provide an inertial navigation capability sufficient to meet the stated requirements in Strategic Air Command Required Operational Capability 6-75 for a high precision navigator. The capability must be Air Force-qualified and nuclear hardened to stated requirements. No Research Development Test and Evaluation funds are provided for either nuclear hardening or prototype systems other than United States Air Force government furnished equipment.

i. (U) Terrain correlation - An operational evaluation of terrain correlation as a navigational aid in the performance of the strategic mission.

j. (U) Air launched missile(s)/aircraft avionics tie-in - Integration of development software/hardware required to support air launched missile delivery.

(U) The development contractor is the Boeing Military Airplane Company in Wichita, Kansas. The Development Test and Evaluation service program manager is the Aeronautical System Division at Wright-Patterson Air Force Base, Ohio. The Operational Test and Evaluation service program manager is the Air Force Test and Evaluation Center at Kirtland Air Force Base New Mexico. The test location will be the Boeing Wichita plant 13. The Edwards Air Force Base facilities may be used for a portion of the combined (missiles and aircraft) test requirements.

(U) Particular emphasis will be placed on testing the operational effectiveness of the fault detection/isolation capabilities of the new equipment. Initial Operational Test and Evaluation test team personnel will maintain the updated avionics system using the same available organizational/intermediate level techniques/equipment that are to be used when the system is deployed.

(U) Preliminary validated technical orders will be provided to Development Test and Evaluation/Initial Operational Test and Evaluation test team personnel to perform maintenance associated with the new systems. These technical orders will be verified during Development Test and Evaluation/Initial Operational Test and Evaluation to provide final tech data for system deployment.

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Budget Activity: Strategic Programs #3

Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

(U) An evaluation of software for the B-52 Offensive Avionics System will be performed by the software assessment team at Boeing Military Airplane Company and Oklahoma City-Air Logistics Center. In the test team, contractor development and test activities, as well as flight testing, will be monitored to assess software performance and suitability factors. The effectiveness of software development tools to support future software maintenance will also be assessed. At Oklahoma City-Air Logistics Center, computer programs and the associated documentation will be evaluated to judge their adequacy for software maintenance.

(U) In addition, a limited simulation capability for the Offensive Avionics System computer complex is planned to allow some performance evaluation of Offensive Avionics System Operational Computer Programs. This activity also begins a buildup of Air Force expertise at Oklahoma City-Air Logistic Command on which to base future organic support for B-52 Offensive Avionics System software.

(U) A high degree of similarity exists between the items tested during Development Test and Evaluation, those tested during Initial Operational Test and Evaluation, and those in the production configuration. Except for minor installation and wiring differences, the subsystems should be completely interchangeable. Software will be continually updated with test findings.

(U) Below are sections for special items of concern which will be evaluated and will affect the Test and Evaluation portion of this program.

a. (U) Reliability:

(1) (U) Primary Mission Equipment shall have a minimum mean time between failure of 43 hours evaluated by burn in, qualification testing, ground tests, and flight tests.

(2) (U) Interface equipment shall have a minimum mean time between failure of 2500 hours.

(3) (U) Aircraft installed equipment shall have a minimum mean time between failure of 400 hours.

b. (U) Maintainability:

(1) (U) The total "on aircraft" maintenance time for new equipment shall not exceed 140 hours per 1000 system operating hours.

(2) (U) The mean time to restore failed equipment "on aircraft" shall not exceed 1 hour.

491
440 491

Budget Activity: Strategic Programs #3

Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

- (3) (U) The mean time to restore failed equipment at the intermediate level shall not exceed 1.5 hours.

c. (U) Environmental Qualification Testing:

(1) (U) All new primary mission equipment will be tested for explosion proof, temperature shock, temperature-altitude, vibration, shock, acoustics, humidity, sand and dust, fungus, salt atmosphere, moisture, radiation, and overpressure using the appropriate Military-Standard.

(2) (U) Vibration testing includes 11 hours of random vibrations at two temperature levels, -55° and 71°C.

d. (U) Test Flights: The program has combined Development Test and Evaluation/Initial Operational Test and Evaluation flights. The Development Test and Evaluation testing requires 44 successful test flights.

e. (U) Management: The test and evaluation program management for the Offensive Avionics System and air launched cruise missile integration is broken out below.

(1) (U) The development portion will be a combined Development Test and Evaluation/Initial Operational Test and Evaluation program and will continue that way through the full scale engineering and development contract. The test portion is from September 1980 through September 1981. The overall program manager is the Strategic Systems System Program Office (ASD/YY) who is also in charge of Development Test and Evaluation. Air Force Test Evaluation Center is responsible for the Initial Operational Test and Evaluation portion in conjunction with the Strategic Systems System Program Office because the program has a combined development and initial operational test and evaluation program.

(2) (U) Beyond the Development Test and Evaluation/Initial Operational Test and Evaluation program, a Follow-on Operational Test and Evaluation is planned with two phases. The first phase (January - December 1982) will be the responsibility of Air Force Test Evaluation Center. After December 1982 Initial Operational Capability or after the Initial Operational Capability occurs, Headquarters Strategic Air Command assumes responsibility for management of this second phase.

2. (U) Operational Test and Evaluation Data:

(U) Testing began in September 1980 and will continue through September 1981.

(U) Testing is being conducted as combined Development Test and Evaluation Initial Operational Test and Evaluation using one Offensive Avionics System modified B-52G aircraft staging from the Boeing Military Airplane Company/McConnell Air Force Base, KS facilities. Test ranges to be used include White Sands Missile Range, Nellis Range, Utah Test and

Budget Activity: Strategic Programs #3

Program Element: 11113F - B-52 Squadrons, Project 2406, B-52 Offensive Avionics System (OAS)

Training Range, and Tonopah Test Range. Boeing Military Airplane Company is the prime contractor. The Air Force Test and Evaluation Center has overall responsibility for Initial Operational Test and Evaluation. Strategic Air Command, Air Force Logistics Command, and Air Training Command will provide personnel to the test team. The objectives of the Initial Operational Test and Evaluation are to:

- a. (U) Evaluate the operational effectiveness of the Offensive Avionics System modified B-52 to perform the Strategic Air Command operational mission (i.e., quick reaction launch, air alignment of the inertial measurement unit, tanker rendezvous, overwater flight, landfall fix, weather avoidance, high and low altitude navigation, high and low altitude gravity weapon delivery, simulated and actual missile launch, Short Range Attack Missile/Air Launched Cruise Missile interoperability, and aircraft recovery).
- b. (U) Evaluate the operational suitability of the Offensive Avionic System (i.e., system reliability, maintainability, supportability, and availability). Reliability and maintainability data will be collected during inflight and ground operation of the system and normal maintenance operations. Additional maintainability events will be conducted to explore the whole range of normal operational maintenance events.
- c. (U) Identify system characteristics or deficiencies which significantly impact operating and support costs. Identify operational deficiencies. Recommend and/or evaluate changes or trade-offs in production configuration. Evaluate the effectiveness of the computational subsystem software, to include functional performance, degraded mode operations, and software man-machine interface.

(U) Several items of support equipment will not be available until late in the Initial Operational Test and Evaluation; in particular the AN/ASM-479 (modified), the AN/GSM-263 electronic systems test set and associated test package sets, and the System Avionics Tester. All three items will be tested in Follow-On Operational Test and Evaluation. During Initial Operational Test and Evaluation intermediate level maintenance will be performed largely by the contractor using special test equipment. Estimates of operational reliability and maintainability for the level of maintenance will consequently be degraded. Supportability of the test sets will be evaluated during Follow-on Operational Test and Evaluation.

(U) The system and subsystems to be tested will be the production configuration. "Patches" to system software will be made during the test and be included in the operational system. Operational Test and Evaluation operations and maintenance personnel will be representative of user personnel.

(U) With the concurrency of the full scale development and production programs, some long-lead production decisions will be made prior to the completion of flight testing. Follow-on operational test and evaluation and nuclear certification testing are planned to be completed by December 1982.

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Budget Activity:
Program Element: Strategic Programs #3
11113F - R-52 Sound

Project: #2548

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: Nuclear Hardness Study/Electromagnetic Pulse

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The purpose of the B-52 Nuclear Hardness Study/Electromagnetic Pulse project is to improve the survivability and vulnerability of the B-52G/H to nuclear effects. The first phase of the study identified program needs. The second phase, which consisted mostly of testing on the trestle facilities and dipole site, identified

A modification to the B-52G/H aircraft for these begins in fiscal year 1981. This modification was built on the analyzing and testing of the basic aircraft systems for blast, thermal, and Electromagnetic Pulse vulnerability. The continuing testing and analysis will develop and verify the nuclear hardened baseline design for the entire B-52G/H weapon system for nuclear blast/thermal/electromagnetic pulse weapon effects, evaluate alternative approaches for hardening, and further examine the needs for additional protection. In addition, the project will test an offensive avionics system and cruise missile modified aircraft with and without the electromagnetic pulse protection kit support a technology base effort and a protocol criterion for evaluation purposes. The project will continue to develop Electromagnetic Pulse fixes to critical aircraft systems not included in the B-52 Offensive Avionics System and Air Launched Cruise Missile efforts.

(U) From 1979 through 1981, an evaluation of the project by the Defense Science Board recommended an expanded test and development program to gather more data. The additional data will permit the consideration of various modification options to increase the probability of strategic aircraft survival against the effects of nuclear weapons.

(U) RELATED ACTIVITIES: PE 64711F Systems Survivability (Nuclear Effects) supports Electromagnetic Pulse testing of the B-52. PE 64711F develops test methodology, procedures, and prescribes trainers needed for Air Force testing. PE 64747 Electromagnetic Radiation develops the nuclear simulator for testing (Project 1209).

(U) WORK PERFORMED BY: The test facilities at the Air Force Weapons Laboratory, Kirtland Air Force Base, NM, will be used for the majority of the actual aircraft, subsystem, and/or piece part testing. Computer facilities at Air Force Weapons Laboratory and selected civilian contractors will also be used.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Headquarters Air Force directed the Air Force Weapons Laboratory to lay out a total evaluation program for the B-52G/H. Phase One was completed by Air Force Weapons Laboratory in 1976. The program was suspended shortly thereafter to allow facility testing to be concentrated on B-1 requirements. Following the cancellation of B-1 production, the B-52 program was re-established in the fiscal year 1978 Supplemental Budget. Efforts through fiscal year 1978 defined the test program, prepared for basic aircraft systems testing, and initial computer analysis was performed. In fiscal year 1979, basic aircraft systems testing began at Air Force Weapons Laboratory on the dipole facility. In 1980, testing begun in the preceding year was completed. In addition, the aircraft was tested on the Trestle facility in fiscal year 1980. The Trestle testing originally proposed in this program was expanded considerably this year to clear up the Electromagnetic Pulse uncertainties of the B-52. Data from the Electromagnetic Pulse portion of the tests was analyzed to initiate development of Electromagnetic Pulse fixes

4/8/84

Project: #2548

Program Element: #11113P

IOD Mission Area: 113, Airborne Strike

Title: Nuclear Hardness Study/Electromagnetic Pulse

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

2. (U) FY 1981 Planned Program: The project is continuing to analyze by subsystem testing and/or by computer analysis the effects of Electromagnetic Pulse on the B-52 in order to complete development of corrective fixes. Production funding for aircraft retrofit is programmed to fund the fixes defined, approved, and developed for modification beginning this year. Planning for outyear testing and analyses will be accomplished.

3. (U) FY 1982 Planned Program: All electromagnetic pulse, blast, thermal, and related aircraft structural problems should be fully identified and efforts will concentrate on testing the selected aircraft modifications, evaluating alternative approaches for strategic aircraft hardening, and further examine the threats and thus the needs for additional protection. A B-52G modified for offensive avionics system and cruise missile carriage will be tested and data will be analyzed for existing levels of protection. Additional modifications needed to provide aircraft protection against the effects of blast and thermal, if required, will be added to the ongoing modification program.

4. (U) FY 1983 Planned Program: The development program to provide electromagnetic pulse protection and associated aircraft survivability and vulnerability problems for the B-52G/H is scheduled for completion this year. A B-52G aircraft modified with the offensive avionics system, cruise missile carriage and electromagnetic pulse protection kit will be tested and analyzed this year. Final technology findings and hardness verifications will be made available to adjust ongoing modification program and to provide follow-on strategic bomber efforts an extremely valuable data base.

5. (U) Program to Completion: Not Applicable

6. (U) Milestones:

A. Start Studies	Fiscal Year 1978
B. Dipole Testing	Fiscal Year 1979
C. Treatle Testing - Basic Aircraft	Fiscal Year 1980/1981
D. Modification Initiation (Tailored Approach) B-52G/H	Fiscal Year 1981
E. Treatle Testing - Offensive Avionics System/ Cruise Missile Carriage Aircraft	Fiscal Year 1982
F. Alternative Approach Analyses	Fiscal Year 1981-1983
G. Treatle Testing - Offensive Avionics System/Cruise Missile Carriage/Protection Kit Aircraft	Fiscal Year 1983

7. (U) Resources (\$ in thousands):

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
EDT&E	16,000	22,565	26,600	13,600		83,865
Procurement	3010	20,000		66,300	119,700	288,600
	3400		10,000	15,500	83,600	109,100

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Project: #2548

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: Nuclear Hardness Study/Electromagnetic Pulse

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	16,000	3,000	39,200	22,700		86,000

(U) The reduction in development funding is due to a change in the scope and definition of project objectives following an evaluation of the project by the Defense Science Board. The modification program, originally deferred until completion of evaluation, has been initiated after the Frestle and related tests. Therefore, procurement funding is now part of the total program.

Project: #2570

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: Electronic System Test Set

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The goal of developing automatic test equipment common to the Short Range Attack Missile and Air Launched Cruise Missile was highlighted in January 1976 when Strategic Air Command identified its requirements for such equipment. In the Short Range Attack Missile B trade study, different options were evaluated to find the most cost-effective common test equipment for the Air-to-Ground Missile 69A, Air-to-Ground Missile 69B, Air-to-Ground Missile 86A, B-52 missile related carrier aircraft equipment, and B-1 applications. A preferred concept resulting from the study was a computerized automatic test equipment common to the two missiles and missile related aircraft systems. The Electronic System Test Set, formerly the Integrated Computerized Test Set, was selected to complement the concept. The advantages of common automatic test equipment, in addition to effecting major changes in projected life cycle costs are: growth potential, system software change flexibility through on-line edit capability and improved operational capability associated with testing all aircraft and missile systems with a single piece of equipment.

(U) The Short Range Attack Missile Program Management Directive, September, 1976, directed the Short Range Attack Missile System Project Office, to develop the automatic test equipment common to the Air-to-Ground Missile-69A, Air-to-Ground Missile 69B, Air-to-Ground Missile 86A, B-1 gravity weapons, and B-52/B-1 munitions related carrier aircraft equipment. The required operational capability for the Air Launched Cruise Missile also stated a need for common automatic test equipment.

(U) When the B-1 and Short Range Attack Missile B missile production were cancelled in July 1977, all Short Range Attack Missile B work except the Electronic System Test Set was stopped. Electronic System Test Set work continued and was expanded to include the Air-to-Ground Missile 109 which had been introduced into the air launched cruise missile competition. Thus Electronic System Test Set satisfies the automatic test equipment requirement for the Air-to-Ground Missile 69A, Air-to-Ground Missile 86B, Air-to-Ground Missile 109 and combination of the Short Range Attack Missile and Air Launched Cruise Missiles, loaded and empty launcher and pylons, and B-52 carrier aircraft equipment at the B-52 integrated maintenance facility.

(U) A review completed in November 1977 reconfirmed the requirement and effectiveness of continuing the development of a common set of automatic test equipment.

(U) RELATED ACTIVITIES: The B-52 Offensive Avionics System modernization program with new digital systems and cruise missile integration and the B-52/SRAM weapon system will benefit from this development effort. The B-52/Short Range Attack Missile/Cruise Missile/Avionics interface units developed under the program can be checked for maintenance corrective action using the Electronic System Test Set.

(U) The cruise missile program will provide funds to develop Electronic System Test Set peculiar cruise missile software to support the competitive flyoff and will also provide later updates to integrate the Electronic System Test Set with the selected cruise missile.

Project: #2570

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: Electronic System Test Set

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #2

(U) WORK PERFORMED BY: The efforts will be accomplished in three areas. One part, represented by the funds shown here under Project 2570, will be carried out by the Boeing Company under contract to the Aeronautical Systems Division of Air Force Systems Command. This part will support the B-52 weapon system and associated missiles. The other two parts will be managed by the Joint Cruise Missiles Program Office and will be performed by Boeing.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1980 and Prior Accomplishments: Development of Electronic System Test Set began under the Short Range Attack Missile program element reacting to requirements for integrated automatic test equipment. The program was interrupted by B-1 and Short Range Attack Missile B production cancellation decisions and a concomitant loss of funding. In 1978, the Electronic System Test Set development continued with remaining Short Range Attack Missile B funds. A total of \$1,999 thousand was reprogrammed into this project in fiscal year 1978. Hardware and system software development along with the fabrication of the first seven Electronic System Test Set ESTS developmental sets will take place.

(U) In 1979, the weapon system peculiar test package sets, which are an integral part of the Electronic System Test Set, began development by the competing missile subcontractors. This effort consisted primarily of software and adapters. In addition the first production configured Electronic System Test Set entered fabrication. These five sets will be used for qualification testing, software validation/verification, and compatibility. Total system capability for the B-52G/H, Short Range Attack Missile, offensive avionics system, and cruise missiles checkout continued to be funded by this project.

(U) In 1980, development of hardware and Short Range Attack Missile/cruise missile/carrier aircraft checkout and support equipment continues. Any modifications required by the uniqueness of the cruise missile selected for production were being incorporated into a final Electronic System Test Set configuration. Funding shortfalls in fiscal year 1979, not made up in the fiscal year 1979 Supplemental Budget, had to be moved into fiscal year 1980. This resulted in a program slip of approximately six months for the full capability. Development efforts were prioritized to concentrate on the Air Launched Cruise Missile, the missile interface unit, and the Short Range Attack Missile in that order.

2. (U) FY 1981 Program: Development required for production deliveries in fiscal year 1981 will be completed to meet the scheduled initial alert capability date of September 1981 and an initial operational capability of December 1982. The fiscal year 1981 program was expanded to include items not completed in fiscal year 1980. The efforts will include development of the remaining Air Launched Cruise Missile test package sets, then working with Short Range Attack Missile test package sets and missile interface unit requirements. Any delays resulting from the Air Launched Cruise Missile production decision during the third quarter of fiscal year 1980 will also have to be made up in this year.

Project: #2570

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: Electronic System Test Set

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

3. (U) FY 1982 Planned Program: This is the last year of the Electronic System Test Set project. Development is scheduled to be completed. Discrepancies discovered during air launched cruise missile and offensive avionics systems integrated testing will be corrected during this year. Modifications and/or additions to this test set may be required when future generations of cruise missiles are introduced into the Air Force inventory.

4. (U) FY 1983 Planned Program: Not Applicable

5. (U) Program to Completion: To Be Determined

6. (U) Milestones:

A. Critical Design Review	Date
B. First Set Fabricated	October 1977
C. System Software Critical Design Review	October 1977
D. Planned Production Start	May 1978
E. Initial Alert Capability	January 1980
F. Initial Operational Capability	September 1981
	December 1982

7. (U) Resources: (\$ in thousands)^{1/}

Development	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs ^{1/}
	11,500	19,100	8,700			64,800

^{1/} Does not include Short Range Attack Missile or Air Launched Cruise Missile contributory efforts.

8. (U) Comparison with FY 1981 Budget Data:

Development	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	13,500	23,400	1,900			62,300

(U) Funds were increased in the fiscal year 1982 request to assure test equipment would meet schedule and testing scope requirements to make up for funding not received in previous years; to compensate for increases due to changes in Air Launched Cruise Missile configuration and subsystems; and adjust for increases in operational and support command requirements for test package sets.

Project: #2571

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: B-52 Aircraft Modernization Program

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The present B-52G/H aircraft systems were designed with technologies available in the early 1950s and are consequently experiencing costs as they continue to age. The B-52 Aircraft Modernization Program focuses on two primary objectives. The first is the likely eventual transition of the B-52G/H force

This transition will require updates to keep the aircraft operationally effective. The second purpose is to ensure the force remains supportable through its predicted extended life into the next century. The shift of outyear mission requirements provided by Headquarters Strategic Air Command and future aircraft problem predictions provided by Headquarters Air Force Logistics Command have been incorporated into the definition and scope of this program. The project will coordinate planning, definition, integration, and eventual flight testing of the overall aircraft modernization.

The B-52 Aircraft Modernization Program (formerly Avionics Update - Phase Two) does

In this context, the B-52 Aircraft Modernization Program represents a systems approach to follow-on B-52 modernization aimed at the eventual transition of the B-52 force mission. A complete aircraft and mission requirement evaluation was done in fiscal year 1980 and a full scale engineering and development contract is scheduled for the second quarter of fiscal year 1981. Thus far the following items are considered minimum requirements for this program: radar system update, integrated pilot/ copilot heading displays, autopilot update, electro-optical viewing systems update, new fuel quantity indicating system, and an improved environmental control system. The radar system and autopilot updates are addressed in separate projects. Crew task loading studies would be initiated to determine the feasibility of a reduced crew configuration. This project will incorporate any related life extension/modernization projects identified in the Life Extension Study carried out in fiscal year 1978.

(U) Defensive avionics systems under development in other program elements will be phased with these actions to provide a total, integrated approach in B-52G/H modernization efforts.

(U) RELATED ACTIVITIES: The program will receive benefits from the completed Low Life Cycle Cost Avionics (PE 63705F), the terminated Electronically Agile Radar (PE 63241F) effort, the Standard Precision Navigator (PE 64201F), and other related Research and Development efforts under the supervision of Air Force Systems Command, and contractor internal research and development efforts. The program objective is to meet the total offensive avionics update requirement as stated in Strategic Air Command Required Operational Capability 6-75. All B-52 related missile development programs will be integrated with other offensive and defensive avionics update projects.

Project: #2571

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: B-52 Aircraft Modernization Program

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) WORK PERFORMED BY: The avionics study which initially identified avionics subsystems for incorporation into this program was accomplished by Boeing Military Airplane Company. The B-52 Offensive Avionics System development program has been assigned to the Boeing Military Airplane Company on a sole source basis. Initial design and definition tasks under the Aircraft Modernization Program has also been awarded to the Boeing Military Airplane Company. There are 80 potential subcontractors on the B-52 Aircraft Modernization Program. The list of subcontractors will not be firm until after source selection which is scheduled for fiscal year 1981.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Low Life Cycle Cost Avionics Study was completed in fiscal year 1976 and fiscal year 1977. Fiscal year 1978 work concentrated on the Offensive Avionics System program.

(U) In 1979, the package began with trade studies, system definition, and initial system design. Efforts identified in the Life Extension Study which require development or prototyping were initiated under the Aircraft Modernization Program tasking if they related to the major headings of offensive avionics, offensive and defensive avionics integration, crew reduction, or reliability, maintainability, and supportability problems.

(U) In fiscal year 1980 Boeing Military Airplane Company was put on contract early in fiscal year 1980 to evaluate operational requirements, logistical support problems, alternative B-52 missions, and to recommend alternative modification options depending on selected B-52 outyear missions. Each option will also include recommended subcontractor requirements. The options will be presented to Air Force and Office of the Secretary of Defense agencies for multiple reviews.

2. (U) FY 1981 Program: The selected aircraft modernization program options will be put into competitive source selection with Boeing Military Aircraft Company and Air Force Systems Command making tentative subcontractor selections. After selections are approved, the program will begin full scale engineering development in early fiscal year 1981. Crew task loading studies would be initiated to determine the feasibility of a reduced crew configuration. Programs identified in the fiscal year 1978 Life Extension Study would also be included. The scope of this project meets Strategic Air Command requirements for the B-52 force. A full scale engineering development contract is planned for the second quarter of fiscal year 1981. The remainder of the year will be used to issue procurement requests for Research, Development, Test and Evaluation items in preparation for system integration and software development. Basic software development and interface with the Offensive Avionics System software package will begin in the Systems Integration Laboratory and Test Facility. Crew configuration will be evaluated to determine if crew composition/location should be changed.

Project: #2571

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: B-52 Aircraft Modernization Program

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

3. (U) FY 1982 Planned Program: During the year, updated subsystems will be received for checkout and integration in the Systems Integration Laboratory and Test Facility. These subsystems and the associated software will be packaged for development/preproduction flight test aircraft modification during the later part of this year. Items/subsets going into the aircraft modification programs procurement in fiscal year 1983 will receive extra attention to ensure completeness. Procurement begins in fiscal year 1982 on at least two subsets because their reliability degrades faster than previously predicted and minimum or no development/preproduction actions are required. The two updates initiated in the fiscal year 1982 amended budget request are the fuel quantity indicator system and the environmental control system. Both system updates require immediate attention to maintain force readiness.

4. (U) FY 1983 Planned Program: The remaining subsets will be integrated into the flight test aircraft. The radar system update, the autopilot, their interfaces, and interfaces with the other project subsets will be totally integrated and flight testing accomplished during this year.

5. (U) Program to Completion: Current planning shows that by fiscal year 1984 a completely integrated, updated modification package could be ready for a production decision. The remainder of the program will be conducting flight and ground testing to the identified program subsets and any other supportability or mission oriented requirements which may be added at a later date.

6. (U) Milestones:

- A. Definition/Trade Studies
- B. Full Scale Engineering Development Contract
- C. Prototyping Initiation
- D. Production Decision - Total Package
- E. First Aircraft - In/Out

Date
Fiscal Year 1979-1980
January 1981
Fiscal Year 1982
Fiscal Year 1983-1984
Fiscal Year 1985

7. (U) Resources (\$ in thousands):

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Actual	Estimated	Estimated	Estimated	to Completion	Estimated
	2,400	6,200	23,500	27,300	Cont	Costs
			36,500	TBD	TBD	Not Applicable
RD&E						TBD
Procurement	3010					
	3400					

Project: #2571

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Aircraft Modernization Program

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Actual	Estimate	Estimate	Estimate	to Completion	Estimated
	<u>2,400</u>	<u>6,200</u>	<u>10,100</u>	<u>18,000</u>	<u>Cont</u>	<u>Costs</u>
RDT&E						<u>Not Applicable</u>

Funding for this project had been previously reduced in concert with the decision

The funding profile to fund the required modernization update developments and provide the update for modification prior to the identified subsystem becoming unsupportable has been determined and entered into the fiscal year 1982 request. The funding profile has increased in the visible years above because reliability/maintainability problems were more immediate than first predicted. The total efforts are less than the penetration protection option and the previous extended development program.

Project: #2601

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: B-52 Strategic Radar

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION:

The forward looking radar requirements for the B-52G/H force and strategic aircraft in general were stated in 1975 by Strategic Air Command. The requirements were based on an outyear penetration role for the B-52 force.

missions requirements, a radar system like the Electronically Agile Radar was required, developed, and tested. Installation, integration, and flight testing of an Electronically Agile Radar (EAR) on a B-52 was completed in FY 1980. However, the Electronically Agile Radar was judged as too sophisticated and expensive

Under the penetration

But, a radar update is still required to support B-52G/H outyear missions and to solve serious reliability/maintainability problems with the existing radar subsystems. This project now represents a restructuring of the entire B-52G/H radar update effort. It will now concentrate on meeting radar subsystem mission and supportability requirements of the Strategic Air Command and the Air Force Logistics Command. The radar update incorporated into the offensive avionics system program was only an interim update until the B-52 outyear missions were determined. Now, the remaining serious radar system problems must be addressed and are the primary objectives of this project. The radar subsystem remains the most unreliable in the bombing navigation system. Air Force Logistics Command has singled out the radar system as unsupportable in the first quarter of

The primary problems being in the transmit/receive section and antenna. Because these parts of a radar system are very sensitive to capability and mission application, updates were withheld in the offensive avionics system project until these factors were determined. Sources for many replacement components are no longer available. Based on this supportability predictions, Strategic Air Command has requested the radar system be updated prior to the expected nonsupportability date. Initiation of the modification is now planned for 1983.

(U) RELATED ACTIVITIES: The technology for this radar update is based on several efforts: The Forward Looking Advanced Multimode Radar effort under Program Element 63203F; the Multi-Mode Radar performed by the Navy and the Reliable Advanced Solid State Radar of the Advanced Avionics Project (63203F); the advanced development Electronically Agile Radar effort (63241F); and the Low Life Cycle Cost Avionics (63705F) effort.

(U) WORK PERFORMED BY: The Aeronautical System Division, Wright-Patterson Air Force Base, an organization of Air Force Systems Command, will manage the project. The integration flight test will be accomplished at Wichita, KS, by the Boeing Military Airplane Company. It is assumed that at least four radar contractors will be competing for this project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Low life cycle studies under Program Element 63705F confirmed the cost-effectiveness of an Electronically Agile Radar like radar to fulfill the requirements of Strategic Air Command penetrating bomber mission requirements. Flight tests were begun.

Project: #2601

Program Element: #11113F

DOD Mission Area: 113, Airborne Strike

Title: B-52 Strategic Radar

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) In 1979, the Electronically Agile Radar/B-52 flight tests continued. Built-in Test/fault isolation tests were accomplished. The weapon system interface trade study was begun to establish cost, schedule and risk of full scale development for a modification program.

(U) In fiscal year 1980, flight tests were completed and test aircraft demodification was initiated. The remaining funds were used to carry out an analysis to define radar alternatives that better match the revised outyear mission objectives of the B-52G/H force.

2. (U) FY 1981 Planned Program: During fiscal year 1981, identification, procurement, initial fabrication and laboratory testing of the selected radar modifications will begin. Software development and test for all radar modes will also be initiated.

Because aircraft avionics systems revolve around the radar system, a concentrated effort will be made this year to move out on this project.

3. (U) FY 1982 Planned Program: The initial hardware parts will be received during this year in order to begin system fabrication, System Integration Laboratory and Test Facility integration, and the build-up of the software package. Test aircraft modification could begin near the end of this year.

4. (U) FY 1983 Planned Program: The updated radar package will be put into flight test aircraft, integrated with other aircraft modernization program subsets.

5. (U) Program to Completion: Project 2601 will complete the engineering development, flight test, evaluation and qualification of an updated radar for the B-52 weapon system.

6. (U) Milestones:

A. SAC ROC 6-75 Approved

B. Initiation of Engineering

C. Completion of Advanced Development (63241/11113F)

D. Delivery of Research Development Test and Evaluation Model

E. Start Flight Testing

F. Production Decision

G. Complete Flight Testing

H. Start Aircraft Modification

Date

December 1976 (Electronically Agile Radar)

October 1979 (Electronically Agile Radar)

January 1980 (Electronically Agile Radar)

October 1981 (Radar Update)

January 1983 (Radar Update)

Fiscal Year 1983 (Radar Update)

March 1984 (Radar Update)

Fiscal Year 1983/1984 (Radar Update)

Project: #2601

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Strategic Radar

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

7. (U) Resources (\$ in thousands):

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Actual	Estimate	Estimate	Estimate	to Completion	Estimated
RDPAE	<u>1,500</u>	<u>6,100</u>	<u>21,200</u>	<u>20,000</u>	<u>16,600</u>	<u>Costs</u>
						<u>65,400</u>

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Actual	Estimate	Estimate	Estimate	to Completion	Estimated
RDPAE	<u>1,500</u>	<u>17,900</u>	<u>21,200</u>	<u>13,000</u>	<u>10,000</u>	<u>Costs</u>
						<u>63,600</u>

(U) The project funding has been increased to maintain the development program and the associated modification programs for the B-52G/H ahead of the logistical reliability/supportability problems and in concert with the latest strategic mission requirements for the B-52.

Project: #2633

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52H Cruise Missile Integration

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides a strategic force option to deploy the cruise missile with the B-52H. The option provides additional cruise missile carriage capability for the B-52H which is similar to that being planned for the B-52G. Program meets requirement to provide an option which protects a fiscal year 1986 operational capability.

(U) RELATED ACTIVITIES: The current ongoing air launched cruise missile development, procurement and B-52G modification programs for cruise missile carriage, offensive avionics system, and observable differences/functionally related observable differences are related activities. The B-52H is currently being modified with the offensive avionics system.

(U) WORK PERFORMED BY: The Aeronautical System Division, Wright-Patterson Air Force Base, OH, and organization of Air Force Systems Command, will manage the project. The contractor is the Boeing Military Airplane Company.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.

2. (U) FY 1981 Program: Not Applicable

3. (U) FY 1982 Planned Program: During this year, modified B-52G data will be used to initiate a B-52H cruise missile integration program. Data on aircraft compatibility and carriage interfaces with the B-52H will be accomplished. Initial test aircraft modifications for flight testing (carriage and launch) will be started.

4. (U) FY 1983 Planned Program: In this year, test aircraft modification will be completed and missile carriage and launch will be accomplished. The necessary data to start the aircraft modification program will be obtained. Project will complete this year.

5. (U) Program to Completion: Not applicable.

6. (U) Milestones:

DATA

A. Development Program
B. Modification Production Decision
C. First Operational Capability

Fiscal Year 1982 - 1983
Fiscal Year 1983
Fiscal Year 1986

Project: #2633

Program Element: #11113

DOD Mission Area: 113, Airborne Strike

Title: B-52H Cruise Missile Integration

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

7. (U) Resources (\$ in thousands):

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDATE			15,000	31,900		46,900

8. (U) Comparison with FY 1981 Budget Data: Not Applicable. This project is a new start for fiscal year 1982.

Project: #2692

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: B-52 Autopilot

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The basic B-52 autopilot technology dates back to World War II. In the early 1960's, its functions were expanded to include the Low Level and Aerial Refueling modes. The Mean Time Between Failure for the existing system is about 15 hours. The age of the autopilot has made it extremely difficult and costly to maintain. The autopilot has been plagued with unscheduled pitch up/down on Low Level and Aerial Refueling modes, roll wallow, erratic aerial refueling operation, and yaw oscillations. Of particular concern are the extremely narrow safety margins in the Low Level and Aerial Refueling modes. The project will provide autopilot updates which will improve reliability, maintainability, and safety to an acceptable level by providing new line replaceable units combining the functions of several existing units that are high failure items and containing a model pitch channel with appropriate comparators. A redundant pitch force transducer and a second altitude source will also be included.

(U) The B-52D has an additional requirement to incorporate an Attitude Heading Reference System to replace the current H-1 compass system. The Attitude Heading Reference System will provide a heading and second attitude input to the autopilot. The Attitude Heading Reference System is a part of the B-52 Offensive Avionics System project on the B-52G/H.

(U) Due to commonality of B-52 autopilot systems, engineering, design and data from this project can be applied not only to the B-52D but also to the B-52G/H. The B-52D problem is more severe and it is therefore scheduled for modification in fiscal year 1982.

(U) RELATED ACTIVITIES: Outputs from this project will be used to support a B-52D Class IV modification. These outputs can also be incorporated in the B-52 Aircraft Modernization Program (Project 2571) to provide for the eventual upgrade of all B-52G/H autopilots.

(U) WORK PERFORMED BY: The B-52 System Manager at Oklahoma City Air Logistics Center, a subdivision of the Air Force Logistics Command, will manage this development project.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.
2. (U) FY 1981 Program: Begin design, fabrication, integration, and prototyping of an autopilot system which has B-52 force wide application and which can be integrated with Attitude Heading Reference System and aircraft data bus systems.
3. (U) FY 1982 Planned Program: The B-52D version will begin thorough flight testing to ensure the system is flight worthy and all safety of flight evaluations are completed. Actions for the B-52G/H will be continued until completion and then transferred to the related projects for B-52 modernization for integrated flight testing.

Project: #2692

Program Element: #111137

DOD Mission Area: 113, Airborne Strike

Title: Autopilot

Title: B-52 Squadrons

Budget Activity: Strategic Programs, #3

4. (U) FY 1983 Planned Program: Project will complete this year. The autopilot package for the B-52G/H will be flight tested this year following aircraft modification. The resulting package will be integrated with other modernization projects and subsets to ensure no conflicts.

5. (U) Program to Completion: Not applicable.

6. (U) Milestones:

- A. Definition/Trade Studies/Contractor Selection
- B. Flight Testing
- C. B-52D Modification Start
- D. B-52G/H Modification Start

Date

Fiscal Year 1981
Fiscal Year 1982
Fiscal Year 1982
Fiscal Year 1983

7. (U) Resources (\$ in thousands):

RT&E	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Procurement	3010	12,500	16,600	15,700		44,800
	3400		6,300	8,000	26,100	42,300
				100	2,600	2,700

8. (U) Comparison with FY 1981 Budget Data:

RT&E	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Procurement	3010	12,500	13,800			26,300
	3400		14,000		25,800	39,800
					2,100	2,100

(U) Cost increase in development is due to the thorough flight testing required for safety-of-flight checkouts for the B-52 models not previously estimated. The previous project estimate was based on B-52D effort only vice a B-52G/H program. New cost estimates reflect data received from the contractors competing for this project.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11142F

DOD Mission Area: Airborne Strike, #113

Title KC-135 Squadrons
Budget Activity Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	12,950	23,414	31,900	TBD	TBD	TBD
2214	Improved Aerial Refueling Systems	900	1,714	2,300			
2391	Avionics Modernization	2,050	2,300	2,900			
2469	KC-135 Reengining	10,000	16,200	24,900			
2425	KC-135 Winglets		3,200	1,800			
2907	Operational Flight Trainer						

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The use of aerial refueling is fundamental to strategic, tactical and mobility operations in support of national strategy. The 25 year old KC-135A tanker -- the cornerstone of the United States Air Force aerial refueling force -- must be modernized if it is to continue to carry out this role. The objective of the KC-135 Squadrons Element is to assess and apply recent technology improvements to the KC-135A, where it is feasible to do so. The most essential project is 2469 - KC-135 Reengining. The present J57 engine is old, deficient in thrust, environmentally unacceptable, and fuel inefficient. Replacement with the selected CFM56 will eliminate these problems and add new capability and service life to the aircraft. Improved aerial refueling systems will permit safer and more efficient transfer of fuel to receivers. Avionics modernization will allow navigation and cockpit operations to be conducted with modern technology equipment. Winglets offer the potential to save four to six percent of the annual fuel used by the KC-135A -- some 35 million gallons saved each year. The Operational Flight Trainer will replace the outdated and unsupportable MB-26 simulator used today by KC-135 crews. This project is a new start for Fiscal Year 1983.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The primary 1982 effort is full scale engineering and development of the selected improvements in each of the projects. The major project -- KC-135 reengining -- will entail modification and ground test of the first aircraft in preparation for flight test in Fiscal Year 1983. In Fiscal Year 1982 follow-on kits will be purchased for future production. \$250,100,000 has been approved to fully fund the desired Fiscal Year 1982 program. Boom nozzle and boom control improvements will be ground and flight tested. A hose-drogue reel system will be completed. The winglets technology base project will be completed. A reduced crew member cockpit design will be completed ready for a production decision. Funding profiles on all projects except reengining are budgetary cost estimates from the Air Force Systems Command. Reengining research and development funds are derived from contractor firm fixed price quotations. Negotiation is 95 percent complete on the final funding requirement for reengining of the first aircraft.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Research, Development, Test and Evaluation	15,000	23,600	27,300		15,000	80,900
Procurement (Aircraft) (one aircraft only)	5,000	44,500	1,500			51,000
Operations and Maintenance (PE #72207F)			3,000			3,000

(U) OTHER APPROPRIATION FUNDS:

KC-135 Reengining (one aircraft)
Procurement (Aircraft)

5,000 102,500 246,800 3,300

354,300 3,300

460

Program Element: #11142P

DOD Mission Area: Airborne Strike, #113

Title: KC-135 Squadrons

Budget Activity Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The ongoing wing reskin structural modification will extend the KC-135 service life to approximately the year 2040. However, present performance, avionics, and efficiency shortcomings exist which must be corrected. The KC-135 is equipped with underpowered, old technology turbojet engines rendering adverse environmental noise and smoke, high fuel consumption, deterioration due to age, and increasing maintenance costs. These characteristics restrict operations, limit operational use to less than optimal performance, place an increasing burden on Operation and Support funds, and reduce safety factors. This program element's objective is to enhance KC-135 operations by elimination of the above deficiencies. Specifically, winglets can reduce fuel consumption by 4-6 percent, improved refueling systems will afford faster fuel offload to receivers and safer operations at critical times, and avionics modernization may allow us to complete the mission more efficiently with fewer crew members. Reengining - a fundamental requirement - accomplishes significant improvements in capability, operational flexibility, energy consumption reduction, environmental protection, and will provide significant Operation and Support cost savings. (See the separate reengining description attached.) In summary, a modernized KC-135 is the goal.

(U) RELATED ACTIVITIES: Winglet development is a joint United States Air Force/National Aeronautics and Space Administration technology base effort. Potential application to other United States Air Force aircraft is a derivative. Program element 72207 contains the installation labor funding required for the KC-135 reengine project.

(U) WORK PERFORMED BY: The KC-135 reengining program is managed by the Aeronautical Systems Division of the Air Force Systems Command, located at Wright-Patterson Air Force Base, OH. The prime contractor is the Boeing Military Airplane Company, Wichita, KS. The engine manufacturer is the CFM Company, a partnership between General Electric of the United States and Snecma of France. The CFM56 engine will be assembled at the CFM plant near Cincinnati, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The numerous improved aerial refueling systems - pumps, hose drogue reel, improved boom controls - have undergone trade study efforts to select the optimum design. They are nearly ready to enter full scale engineering and development. KC-135 reengining engine source selection is complete. Preliminary design is underway and long lead materials are being purchased for the first production certification aircraft. In the avionics project, the feasibility determination of a reduced crew member cockpit is almost complete. In the winglets areas, the joint technology base effort is nearing completion. This will allow the Air Force to begin development of a winglet set optimized for the KC-135A.

2. (U) FY 1981 Program: Improved aerial refueling systems will enter full scale engineering development and feasibility flight testing of the hose reel system while completing flight testing of the offload pumps. Reengining (see attached summary for full description) will complete the Critical Design Review and engineering for the first production aircraft. Procurement of the first aircraft hardware will also be accomplished. The additional funds provided by Congress will procure tooling and long lead materials for follow-on KC-135R production. Avionics modernization, if continued, will move into full scale engineering development of an improved cockpit design. Winglets will complete detail design of the configuration optimized for the KC-135 aircraft.

3. (U) FY 1982 Planned Program: In full scale engineering development the improved boom, improved nozzle, and hose reel system will complete feasibility flight testing. Support equipment will be developed. Reengining integration and fabrication of the first aircraft continues in preparation for flight test in fiscal year 1983. Ground test occurs in

Program Element: #11142F

DOD Mission Area: Airborne Strike, #113

Title: KC-135 Squadrons

Budget Activity: Strategic Programs, #3

late fiscal year 1982. Follow-on procurement of approximately thirteen reengining kits and associated start-up costs for fleet modification begins. Avionics full scale engineering development should be complete and a production decision will be made if appropriate.

4. (U) PY 1983 Planned Program: Improved aerial refueling systems production and any appropriate residual research and development as appropriate on the boom nozzle and boom control improvements will be accomplished. Production funds required will be determined. The reengineed configuration will be certified and flight tested and follow-on test and evaluation will be completed by September 1983. Funds are added for this effort. Residual research and development and remaining production integration engineering will be accomplished. The Operational Flight Trainer (OFT) program will be initiated with a competitive procurement for the prototype.

5. (U) Program to Completion: Improved aerial refueling system research and development should be complete. A modernized aerial refueling system for the KC-135 will be in the installation process. For reengining completion, selected remaining Research and Development (e.g., landing gear durability tests, Arnold Engineering Development Center test) will be accomplished. In avionics, modification of the aircraft cockpit will begin, if approved. Rate modification with the wingleted configuration will begin, if feasible and funded. All programs will be ready for production, if funded. The Operational Flight Trainer will finish prototype development and begin the production process for follow-on flight trainers. Thirty-six trainers are required.

Funding differences between Fiscal Year 1981 and Fiscal Year 1982 descriptive summaries are due to the additional required research and development on previously undefined reengine requirements: Arnold Engineering Development Center (engine) test, fifth nacelle and strut test, landing gear durability test and nuclear hardness tests. These items would not have been accomplished under a strict prototype Research and Development package. They are requested as part of the production certification process desired by the Congress to complete a full up production aircraft. \$2,500,000 has been added in Fiscal Year 1982 to fulfill the required R&D efforts. \$246,800,000 has been added to the procurement account to begin follow on production at an optimum rate of six aircraft per month. In addition, the new start for a replacement Operational Flight Trainer is contained in Fiscal Year 1983. All other changes are inflation additions or subtractions.

6. (U) Milestones: Not applicable.

Project: #2469

Program Element: #11142F

DOD Mission Area: Airborne Strike, #113

Title: KC-135 Reengining

Title: KC-135 Squadrons

Budget Activity Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force operates 615 primary KC-135 aircraft, all of which are required to support the strategic bomber and reconnaissance forces committed to the general war plan. These same aircraft are also tasked in a host of contingency plans to provide for the deployment and employment of our tactical fighter force and to provide critically needed refueling to the airlift force as well. Numerous studies confirm that we need substantially more aerial refueling capability than is available in the present or programmed KC-135/KC-10 force. As an example, the fuel requirement for the shoot and penetrate era of the mid-1980s increases by 30 percent because of B-52 Air Launched Cruise Missile range penalties. Other non-strategic air refueling requirements have increased significantly since nearly every front line aircraft now in the Air Force has air refueling capability. Reengining provides increased operational flexibility by eliminating the current dependence on extremely long runways. More importantly, reengining with a modern, fuel efficient engine will save vast amounts of fuel and eliminate the environmental difficulties -- noise and particulate pollution -- of the current engine, while reducing Operations and Support costs. A summary of the reasons for reengining is as follows:

- (1) Air Refueling Capability Increases: Offload increase (30-200 percent depending on scenario--an average of 50 percent).
- (2) Operational Flexibility: Operation from shorter runways (North Atlantic Treaty Organization, United States dispersal, Air National Guard/Air Force Reserve). 130 more Continental United States/171 more North Atlantic Treaty Organization runways are usable for KC-135 operations.
- (3) Savings of Scarce Resources: 110,000,000-125,000,000 gallons of fuel per year with a fleet retrofit.
- (4) Environmental: Significantly reduces exhaust, air pollution, and noise emissions. Overseas basing problems are also reduced (e.g., Fairford, England).
- (5) Reduced Operations and Support Costs: Newer technology engines reduce costs (40-50 percent) and would permit a cost avoidance of a percentage of the \$1.2 billion J57 rehabilitation costs required to restore the J57 engine.

(U) RELATED ACTIVITIES: The CFM56 engine has completed development and certification on the Boeing 707 aircraft reengineed prototype which accumulated some 200 flying hours of operation. It has been selected by several commercial airlines to reengine their DC-8 aircraft (Delta, Flying Tiger, United, Capitol). The engine was selected after a comprehensive two-year technical and cost evaluation by the Air Force. It will provide significantly increased fuel offload capability and reduction in fuel consumption, as well as superior emission and noise performance. It meets all United States Air Force emission goals and the 1985 Federal Aviation Regulations for commercial operators. This engine, derived from the B-1 aircraft engine, also contains long range reliability and maintainability design features. The French Government has joined the Air Force effort in 1981. They will reengine their 11 KC-135F aircraft in conjunction with the United States Air Force effort and will contribute funds to the total developmental effort.

(U) WORK PERFORMED BY: The developmental effort on the KC-135 reengine program is managed by the United States Air Force Aeronautical Systems Division and the Boeing Military Airplane Company. Modification of the initial vehicle involves much more extensive development and nonrecurring costs than just integrating engines on the airframe. There are 34 major systems and subsystems involved which will require considerable design and engineering. Nonrecurring production and test costs encompass most of the first article costs, thus distorting the actual flyaway cost which is approximately \$10.0 million (Fiscal Year 1980 dollars). As an aircraft Class V modification, management of the program will revert to the Air Force Logistics Command after the first aircraft effort is complete.

Project: #2469

Program Element: #11142P

DOD Mission Area: Airborne Strike, #113

Title: KC-135 Reengining

Title: KC-135 Squadrons

Budget Activity Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The KC-135 reengine program was approved for the first aircraft development effort. Congressional language directed an accelerated production oriented program. The engine source selection was completed in January 1980. Design engineering and trade studies on subsystems are ahead of schedule. Airplane #1 Production Readiness review #1 has been completed.
2. (U) FY 1981 Program: First aircraft tooling, mock-up and engineering will be completed. The Critical Design Review will occur in March 1981, three months ahead of schedule. The program will be considered ready for production in a low risk manner at this point and production tooling and long lead materials for follow-on aircraft will be ordered when funds are approved for Fiscal Year 1981 use. The additional funds provided by the Congress for tooling and long lead materials will accelerate follow-on production.
3. (U) FY 1982 Planned Program: Installation tooling will be completed. Fabrication and modification of the first aircraft will be completed. Engine and strut tests will be completed. Ground test will begin. Production Readiness Review #2 will be completed. Aircraft kits for follow-on modifications of aircraft will be ordered to begin retrofit of the 615 primary aircraft KC-135 fleet.
4. (U) FY 1983 Planned Program: The aircraft will undergo and complete ground and flight tests by the third quarter. Initial and Operational Follow-on Test and Evaluation will be completed in the fourth quarter of Fiscal Year 1983. Additional funds, previously undetermined, are added for these efforts.
5. (U) Program to Completion: During Fiscal Year 1984, residual research and development and test is accomplished on the first aircraft and appropriate subsystems. Landing gear durability, fifth nacelle and strut, nuclear hardness test, engine health monitor development and Arnold Engineering Development Center test of the engine will be finished. Additional funds have been requested for this effort. The aircraft will be fully complete by the third quarter of 1984.

6. (U) Milestones:

A. Engine Source Selection Completed	22 January 1980
B. Engine Production Readiness Review #1	23 September 1980
C. Preliminary Design Review	21 October 1980
D. Complete #1 Airplane Specification Release	29 October 1980
E. Start Tooling	17 November 1980
F. Airplane Production Readiness Review #1	18 November 1980
G. Mock-up complete	15 December 1980
H. Critical Design Review	2 April 1981
I. #1 Airplane engineering complete	7 May 1981
J. Complete detail tools	27 July 1981
K. Final raw material available	1 August 1981

Project: #2469

Program Element: #11142F

DOD Mission Area: Airborne Strike, #113

Title: KC-135 Reengining

Title: KC-135 Squadrons

Budget Activity Strategic Programs, #3

- L. Start fabrication of Fan Ducts
- M. Final engineering complete
- N. Start Fan Duct assembly
- O. Engine #1 on-dock
- P. Complete installation tooling
- Q. Start airplane modification
- R. Complete Fan Duct fit check
- S. Start engine test at Peebles, OH
- T. Strut build-up complete
- U. Complete test at Peebles
- V. Complete airplane modification
- W. Start ground test
- X. Engine Production Readiness Review #2
- Y. Airplane Production Readiness Review #2
- Z. Complete ground test
- a. Start flight test
- b. Complete flight test
- c. Start Operational Test and Evaluation
- d. Complete Operational Test and Evaluation

- 4 August 1981
- 22 September 1981
- 30 September 1981
- 4 January 1982
- 25 January 1982
- 22 February 1982
- 1 March 1982
- 15 March 1982
- 5 April 1982
- 10 May 1982
- 11 June 1982
- 15 June 1982
- 29 June 1982
- 12 July 1982
- 14 October 1982
- 15 October 1982
- 9 June 1983
- 9 June 1983
- 9 September 1983

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Research, Development, Test and Evaluation	10,000	16,200	24,900	15,400	19,900	86,400
Procurement	5,000	102,500*	246,800	-	-	354,300
Operation and Maintenance (PE 72207)	-	-	3,300	-	-	3,300

* Congressional add on of +\$60,000,000 for tooling and long lead material for follow-on production was included in the Fiscal Year 1981 Appropriations Bill. FY82 Amended Request added \$2,500,000 in R&D and \$216,300,000 in Procurement.

8. (U) Comparison with FY 1981 Budget Data:

Research, Development, Test and Evaluation	10,000	15,000	22,000	15,000	62,000
Procurement (Aircraft)	5,000	44,500	31,500	-	51,000
Operation and Maintenance (PE 72207)	-	-	3,000	-	3,000

RDT&E changes are in inflation cost additives, \$2,500,000 for test in FY82 and the addition of the "additional to completion funds (\$19,900,000) which were not previously defined. They will occur in the Fiscal Years 1983 and 1984 periods and are as described under "Program to Completion." Procurement funds (\$246,800,000) have been added in Fiscal Year 1982 to begin follow on procurement of reengining production kits and non-recurring costs.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11212F

DOD Mission Area: Land-Based Strike, #111

Title: Titan Squadrons

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	1,300	884	0	TBD	TBD	TBD
	Command, Control, Communications Integration	1,300	884	0	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides an improvement to the Titan II Intercontinental Ballistic Missile force to enhance its contribution to strategic deterrence. This improvement is the integration of new command control, and communications equipment into Titan II launch control centers.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Funds to continue the Titan II Command, Control, Communications Integration program are not being requested in fiscal year 1982. This item is deleted as an efficiency reduction in the Amended Budget request. Titan II will rely on existing communication systems for approximately one year longer than previously planned.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,300	900	300			3,300
Procurement (Missile)	4,100	9,700	10,100		2,300	26,200
<u>(U) OTHER APPROPRIATION FUNDS:</u>						
Procurement (Missile)	4,100	9,700	0	TBD	TBD	TBD

Program Element: #11212F

DOD Mission Area: Land-Based Strike, #111

Title: Titan Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Titan II Intercontinental Ballistic Missile achieved full operational capability (54 missiles) in December 1963. Flight testing was terminated in May 1969. The Universal Space Guidance Set deployment was started in April 1978 and was completed in December 1979, as a Class IV modification.

The objective of the on-going program is to develop improvements for the Titan II which will maintain this force as a strong and viable deterrent. The current improvement is the integrated installation of three new command, control, and communications systems into Titan II launch control centers: Air Force Satellite Communications System, 616A (provides jam resistance for the Survivable Low Frequency Communication System), and Strategic Air Command Digital Network. The satellite terminals and 616A will be independently installed first, followed by full integration with the digital network on a schedule compatible with deliveries of the latter.

(U) RELATED ACTIVITIES: 616A is being procured under Program Element #33131F. Program Element #33601F provides for development and procurement of the satellite terminal hardware, except for the Ultra High Frequency antenna. The digital network is being developed and procured under Program Element #11316F. The communications equipment will be delivered as Government Furnished Equipment to the Titan Integration Program. These communications systems will also be installed in the Minuteman Missile Weapon System with development funds in Minuteman Squadrons, Program Element #11213F. Duplication is avoided by assigning integration for all missile launch control centers to one agency, the Ballistic Missile Office.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Ballistic Missile Office, Norton Air Force Base, CA. The implementing agency is the Air Force Logistics Command's Ogden Air Logistic Center, Hill Air Force Base, UT. The principal contractor is the Martin-Marietta Company, Denver, Co.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The communications integration program was initiated in October 1978.
2. (U) FY 1981 Program: Design of the accommodation hardware for the satellite terminals and 616A will be completed with a critical design review in April 1981, then qualification testing will be completed. Design for integration of the digital network will begin.
3. (U) FY 1982 Planned Program: Work will not be performed on this program in fiscal year 1982.
4. (U) FY 1983 Planned Program: The program will be considered for resumption in fiscal year 1983.

Program Element: #11212F

DOD Mission Area: Land-Based Strike, #111

Title: Titan Squadrons

Budget Activity: Strategic Programs, #3

5. (U) Program to Completion: To be determined.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11213P
DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
	Command, Control, Communications Integration	35,300	53,300	33,600	42,100	16,800	4,000,000
	Airborne Launch Control System Phase III	14,100	19,900	10,400	4,500		54,500
	Radar Signal Processor	10,000	26,800	19,300	27,500		88,600
	Program Support	4,100					6,200
		7,100	6,600	3,900	10,100	16,800	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The program provides improvements and modifications to the Minuteman Intercontinental Ballistic Missile force to enhance its contribution to strategic deterrence. Improvements and modifications include integration of new command, control, and communications equipment into Minuteman launch control centers, enhancement of the Airborne Launch Control System capability, and acquisition of MK 12A reentry vehicles.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds to continue design and testing of the accommodation hardware needed to integrate and install the new command, control, and communications equipment. This will provide Minuteman with enhanced communications capabilities compatible with all Single Integrated Operational Plan forces. Also included in this request are funds to complete Airborne Launch Control Systems Phase III equipment design and to initiate ground testing. The Airborne Launch Control System Phase III will provide missile sortie status reporting and remote retargeting capabilities to the airborne missile crews. These costs are based on current program office and contractor estimates.

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Program Element: #11213F

DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons
Budget Activity: Strategic Programs, #3

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	35,300	48,300	40,000		26,400	3,968,900
Procurement (Missile)	105,200	130,900	89,000		44,900	8,819,800*
<u>OTHER APPROPRIATION FUNDS:</u>						
Procurement (Missile) Total	105,200	132,800	93,900	39,700		8,814,200*
MK 12A Reentry Vehicle	87,800	88,900	35,800			371,100
Command, Control, Communi- cations Integration	13,800	42,000	56,400	38,700		150,800
Airborne Launch Control System Phase III	3,600	1,900	1,700	1,000		8,200
Procurement (Aircraft)**						
Airborne Launch Control System Phase III			11,200	24,700		35,900

* Includes initial spares

** In Program Element #11142F, KC-135 Squadrons

Program Element: #11213F

DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Minuteman weapon system was initially conceived in the late 1950s and was developed to provide a rapid reaction Intercontinental Ballistic Missile that would be storable for long periods of time in underground launch facilities to provide survivability. Minuteman has served as a prime nuclear deterrent force of the United States for almost 20 years. The currently deployed Minuteman II and III missiles are three-stage solid propellant ballistic missiles which are guided to their targets by all-inertial guidance and control systems. The missiles are deployed in hardened and dispersed underground silos which are unattended, but constantly monitored by an electronic system which provides data to an underground launch control center manned by two officers. There is one launch control center for each ten missiles. The missiles can also be launched by the Airborne Launch Control System aircraft, at least one of which is airborne at all times. The Minuteman III uses the same rocket motors for the first and second stages as Minuteman II, but a higher performance third stage, and a post-boost vehicle (consisting of a post-boost propulsion system, the missile guidance set, and the MK 12 reentry system) has been added. With the improved third stage and the post-boost propulsion system, the Minuteman III missile can deliver multiple independently targetable reentry vehicles (MIRVs) and their penetration aids to multiple targets. The present force structure of 450 Minuteman II and 550 Minuteman III missiles was achieved in July 1975. The survivability of the Minuteman force was enhanced by the Upgrade Silo Program which provides improved blast and shock, radiation, and electromagnetic pulse protection to Minuteman silos. Modification of all silos was completed in January 1980.

(U) The objective of the on-going program is to improve the Minuteman Weapon System to ensure it remains a strong and viable deterrent. The program includes development of improvements enhancing command and control and force effectiveness. The silo-based Minuteman system is survivable today due to the hardness improvements of the Upgrade Silo Program and will remain survivable against the projected threat into the 1980s. The current program includes three basic tasks: MK 12A; Command, Control, and Communications Integration; and Airborne Launch Control System Phase III. Programmatic support for these development tasks (e.g., Systems Engineering/Technical Direction support, collateral testing and analyses, travel, etc.) are provided at the program level. This summary addresses the overall program and includes total funding for the development tasks and program support. The direct development tasks are described in two separate descriptive summaries. Development of the MK 12A was completed in 1979 and deployment is on-going in 1981.

(U) RELATED ACTIVITIES: Advanced Ballistic Reentry Systems, Program Element #63311F, is a Department of Defense program which develops reentry system technology having potential application to Minuteman. The new strategic missile program, M-X, Program Element #64312, is developing system technology for the next generation missile. The Minuteman program supports guidance technology as an outgrowth of the Missile Performance Measurement System. Duplication is avoided by assigning all of these programs and Minuteman development activities to a single organizational entity, the Ballistic Missile Office. Relative to the communications integration program, the three communications systems are each being developed and procured by their respective program elements and the equipment will be delivered to the Minuteman integration program as Government Furnished Equipment (as described in the project section) for integration into the Minuteman System. These communications systems will also be

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Program Element: #11213F

DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

installed in the Titan II Missile Weapon System, with development funds in Titan Squadrons, Program Element #11212F. Duplication is avoided by assigning Command, Control, and Communications Integration for all ICBM Launch Control Centers to the Ballistic Missile Office.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Ballistic Missile Office, Norton Air Force Base, CA. The principal contractors and their responsibilities are: TRW Systems, San Bernardino, CA - system engineering and technical direction; the Boeing Company, Seattle, WA - assembly and checkout, missile interstages, and system testing; Rockwell International, Autonetics Division, Anaheim, CA - guidance and control; Thiokol Corporation, Wasatch Division, Brigham City, UT - Minuteman III Stage I and III motors; Aerojet Solid Propulsion Company, Sacramento, CA - Minuteman III Stage II motors; General Electric Company, Philadelphia, PA MK 12 and 12A Reentry Systems; GTE Sylvania, Incorporated, Needham Heights, MA - ground electronics; and Bell Aerospace Corporation, Buffalo, NY - Propulsion System Rocket Engine.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Minuteman II developmental flight program was concluded in February 1968. Ninety percent of the 51 launches were successful. Five hundred (500) Minuteman IIs were deployed with Minuteman Is, making a total 1,000-missile force. The first developmental flight of Minuteman III was conducted in August 1968. Through July 1971, a total of 25 Minuteman III developmental flights were conducted, of which 19 were successful. Initial Operational Capability for Minuteman III was achieved in June 1970. Continued deployment of Minuteman III resulted in a force mix of 450 Minuteman II and 550 Minuteman III missiles by the end of July 1975. Nineteen Minuteman III Special Test Missiles and 19 Production Verification Missiles (which verify performance of new subsystems and qualify new production hardware) have since been successfully launched. The last Minuteman III developmental flight test was conducted in March 1980. Design and development of modifications to protect Minuteman III missiles from the effects of nuclear dust and debris were completed and incorporated into the operational force. Development of silo improvements for increased blast, shock, and electromagnetic pulse hardness was completed. Design, development, and test of Minuteman III Command Data Buffer remote retargeting capability for Wings III, V, VI, and Squadron 20 were completed. A formal demonstration of Command Data Buffer system operation was successfully conducted in November 1972, and deployment was completed. Development of the Missile Performance Measurement System was completed in 1977. This is an airborne instrumentation system which provides improved performance data on the Missile Guidance System. The MK 12A and Guidance Improvement Programs were started in 1975. Through 1980, there have been 14 MK 12A flight tests and 25 Guidance Improvement test flights. Development of the MK 12A is complete and deployment began in December 1979. Deployment of the new software developed in the Guidance Improvement Program was completed in September 1978. The Force Modernization Program to improve silo hardness was completed at Wing IV (Whiteman AFB, MO) in January 1980, completing the entire program. Testing and data analysis for the Radar Signal Processor program was completed and this program will now be transferred for implementation as a weapon system modification. The Airborne Launch Control System Phase III program was initiated in October 1978 and the Preliminary Design Review was conducted in September 1980. The Command, Control, and Communications Integration was initiated in October 1978 and design activity has been completed for installation of the Air Force Satellite Communications system terminals and a jam resistant modification to the Survivable Low Frequency Communication System (616A).

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Program Element: #11213P

DOD Mission Area: Land-Based Strike, #111

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

2. (U) FY 1981 Program: Deployment of the MK 12A will continue. Design of the Airborne Launch Control System Phase III system will be completed with the Critical Design Review in September 1981. Development will be initiated to expand the program scope to include all 550 Minuteman III missiles. Testing of the 616A and satellite terminal accommodations will be completed and assembly and checkout will begin; designs for the Strategic Air Command Digital Network integration will be initiated.
3. (U) FY 1982 Planned Program: Deployment of the MK 12A will continue. Ground testing of Airborne Launch Control System Phase III will be completed and procurement for the aircraft modifications will begin. The major part of the 616A and satellite terminal installation will be completed and design and testing of the digital network accommodations will be completed. The decrease in RDT&E funding is due to a realignment of tasks between the Minuteman and Titan programs; comparable increases appear in the Titan Program Element.
4. (U) FY 1983 Planned Program: Deployment of the MK 12A will be completed in early fiscal year 1983. Airborne qualification and proof-testing will be conducted for Airborne Launch Control System Phase III. Design and testing of the digital network integration will be completed.
5. (U) Program to Completion: Installation of Airborne Launch Control System Phase III hardware will be accomplished between January 1984 and April 1985. Installation and integration of the three communications systems will be completed in FY 1985. Procurement funds were transferred to the Titan Program Element due to the realignment of tasks between the Minuteman and Titan programs; (comparable increases appear in the Titan Program Element). Increase in the RDT&E total estimated costs are due to a recosting for the basic Airborne Launch Control System Phase III program, and the Defense Appropriation Bill add to expand the scope of the program.
6. (U) Milestones: Not applicable.

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Project: # N/A

Program Element: #11213P

DOD Mission Area: Land-Based Strike, #111

Title: Command, Control, and Communications Integration

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Three command, control and communications systems will be incorporated into the Minuteman launch control centers. These are the 616A Survivable Low Frequency Communication System, the Air Force Satellite Communication system and the Strategic Air Command Digital Network. The 616A will improve survivable low frequency communications for receipt of emergency action messages. The satellite system will provide a two-way ultra-high frequency communication capability for launch control centers to receive and transmit via satellite to higher authority. The digital network will provide replacement equipment for the existing 465L system which uses dedicated land lines for high speed two-way traffic. In addition, the digital network's User Terminal Element will serve as the functional integrating unit for processing all record traffic including receiving emergency action messages and providing a common output for the missile crew operator. The Communications Integration Program will integrate and install these systems into the launch control centers to ensure proper installation, to minimize the impact on cooling air/power requirements, to eliminate duplicate emergency action message processing, and to ensure system operability during time urgent situations. The program started in October 1978 with initial design work on the 616A and satellite systems. The Minimum Essential Emergency Communications Network Message Processing System was previously envisioned as a separate system which would reduce transmission time over low frequencies. It has now been determined that this function can best be incorporated into the other systems, so it is no longer part of this program. Since there are two configurations of ground electronics in Minuteman launch control centers, commonly referred to as the A-M and B systems, two distinct design efforts are required for installing the communications systems.

(U) RELATED ACTIVITIES: 616A is being procured under Program Element #33131P. Program Element #33601P provides for development and procurement of the satellite terminals, except for the Ultra High Frequency antenna. The digital network hardware is being developed and procured under Program Element #11316P. Integration and installation into the Titan II missile system is funded in Program Element #11212P. Duplication is avoided by assigning the integration and installation of these systems into all missile launch control centers to the Ballistic Missile Office.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force System Command's Ballistic Missile Office, Norton Air Force Base, CA. The principal contractors and their responsibilities are: TRW Systems, San Bernardino, CA - system engineering and technical direction; the Boeing Company, Seattle, WA - systems installation and integration for the A-M system; and GTE Sylvania, Incorporated, Needham Heights, MA systems installation and integration for the B system.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Communications Integration Program was initiated in October 1978. Preliminary designs of the 616A and satellite terminal accommodation hardware were completed.

Project # N/A

Program Element: #11213F

DOD Mission Area: Land-Based Strike, #111

Title: Command, Control and Communications Integration

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

2. (U) FY 1981 Program: Critical Design Reviews will be conducted and testing will be completed for 616A and the satellite terminals, and assembly and checkout will begin. Design for integration of the digital network will be initiated.

3. (U) FY 1982 Planned Program: Design and testing of the digital network integration will be completed. The major part of the 616A and satellite system installation will be completed.

4. (U) FY 1983 Planned Program: Critical Design Reviews for the digital network integration will be conducted in October 1982 and April 1983 and final qualification testing will be performed.

5. (U) Program to Completion: Installation and integration of the digital network will be accomplished between January 1984 and mid-fiscal year 1985.

6. (U) Milestones: Not applicable.

7. (U) <u>Resources:</u>	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDTE	14,100	19,900	10,400	4,500		54,500
Procurement (Missile)	13,800	42,000	56,400	38,700		150,800
8. (U) <u>Comparison with FY 1981 Budget Data:</u>						
RDTE	14,100	19,900	17,300			61,200
Procurement (Missile)	13,800	41,300	54,900			154,900

The decreases in RDTE and procurement funding in this Program Element are due to a realignment of tasks between the Minuteman and Titan Programs; comparable increase appears in the Titan Program Element.

Project # N/A

Program Element: #11213F

DOD Mission Area: Land-Based Strike, #111

Title: Airborne Launch Control System (ALCS) Phase III

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Airborne Launch Control System Phase III Program started in October 1978. It will provide to a portion of the aircraft the capabilities to receive sortie status via a data link directly from the Minuteman silos and remotely retarget missiles in a manner similar to the Command Data Buffer capability available in the Minuteman III launch control centers. This capability will provide a highly survivable launch platform for status and retargeting. This will improve force effectiveness by allowing retargeting of remaining missiles to highest priority targets. This program was scheduled to start in fiscal year 1978, but due to cost growth was redefined for a less costly approach and scheduled for a new start in fiscal year 1979. The new, more austere program will provide these new capabilities to nine EC-135 aircraft for interoperability with 200 Minuteman III missiles. A follow on effort will also be initiated to expand the program to include all 550 Minuteman III missiles. The program plan, milestones, and costs for the expanded effort will be developed in a systems requirements analysis during fiscal year 1981, so these items will not be discussed further in this descriptive summary.

(U) RELATED ACTIVITIES: Modifications to EC-135 aircraft to accept the Airborne Launch Control System Phase III hardware and procurement of that hardware are being accomplished in Program Element #11142F.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Ballistic Missile Office, Norton AFB, CA. The principal contractors and their responsibilities are: TRW Systems, San Bernardino, CA system engineering and technical direction; the Boeing Company, Seattle, WA - airborne equipment development and integration.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Development was initiated in October 1978. Preliminary system requirements analyses culminated in a system design review in June 1979, and the Preliminary Design Review was conducted in June 1980.
2. (U) FY 1981 Program: Component testing will be performed and aircraft modification design will be completed with the Critical Design Review in September 1981. Systems requirements analysis will be conducted to expand the program scope to include all 550 Minuteman III missiles.
3. (U) FY 1982 Planned Program: Fully integrated ground testing will be performed with the system mounted in a mobile van operating at a Minuteman silo at the Hill (Air Force Base) Engineering Test Facility.
4. (U) FY 1983 Planned Program: A prototype system will be installed aboard an EC-135 for in-flight demonstration and performance and qualification testing.
5. (U) Program to Completion: Deployment in operational aircraft will start in January 1984. The first aircraft will be operational in March 1984, and the last, in April 1985.

Project # N/A

Program Element: #11213P

DOD Mission Area: Land-Based Strike, #111

Title: Airborne Launch Control System (ALCS) Phase III

Title: Minuteman Squadrons

Budget Activity: Strategic Programs, #3

6. (U) Milestones:

- A. Development Start
- B. Critical Design Review
- C. First Operational Aircraft Modified
- D. Deployment Complete

Date

October 1978

September 1982

*(1983) March 1984

*(1984) April 1985

* Dates presented in Fiscal Year 1981 Descriptive Summaries.

Explanation of Milestone Changes: A formal costing analysis resulted in total program cost growth and a resultant stretch-out of the schedule.

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDTE	10,000	26,800	19,300	27,500		88,600
Procurement (Missile)	3,600	1,900	1,700	1,000		8,200
Procurement (Aircraft)*			11,200	24,700		35,900

* In Program Element #11142F, KC-135 Squadrons.

8. (U) Comparison with FY 1981 Budget Data:

RDTE	10,000	21,300	18,900	56,900
Procurement (Missile)	3,600	1,900		5,500

A formal costing analysis was performed in preparation of definitization of the development contracts. This resulted in the development cost growth indicated in Fiscal Year 1983 RDTE and in the Total Estimated Costs. The Aircraft Procurement funds were not included in the Fiscal Year 1981 Descriptive Summaries since they are not in the Minuteman Program Element, but they are now included above for completeness in describing this program. Finally, \$5.0 million was added for fiscal year 1981 RDTE in the Defense Appropriations Bill to expand the program scope to include all 550 Minuteman III missiles.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11312F

Title: Post Attack Command and Control System (E-4)

DOD Mission Area: Strategic Command and Control, #131

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs N/A
<u>TOTAL FOR PROGRAM ELEMENT</u>							
2211	Block I	24,500	7,000	3,400	3,700		365,100
2212	Future Blocks			6,200	3,700	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The overall objective of the E-4 Program is to develop and acquire the E-4B system to support the National Emergency Airborne Command Post and the Strategic Air Command Airborne Command Post missions. The E-4 provides significant improvements in capability, survivability, and reliability for the command and control of strategic forces in the pre, trans, and post attack phases of a general nuclear war.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds for Contractor Support Services for the first E-4B development aircraft. Begins engineering design and development of the necessary integration packages for incorporation of Block II equipments necessary to maintain compatibility with existing and evolving elements of the Worldwide Military Command and Control System. Cost estimates are based on historical data and man-year costs to accomplish level-of-effort tasks and were developed as of 25 July 1980.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs N/A
<u>RDT&E</u>						
Procurement (Aircraft)	24,500 121,100	8,100 144,663	7,200 156,600		751,629	1,280,892
<u>(U) OTHER APPROPRIATION FUNDS:</u>						
Procurement (Aircraft) (Project 2211)* (Quantity Retrofit) (Quantity New)	114,300 (1)	145,400 (1)	111,600 (1)	290,100	290,800	1,061,300 (3)
Procurement (Aircraft) (Project 2212) Military Construction Operations and Maintenance (PE 72207)	3,500	800	800	(1) 7,700	(1) Continuing	(2) N/A 19,700 139,100

*Includes Modification and Initial Spares

Program Element: #11312F

DOD Mission Area: Strategic Command and Control, #131

Title: Post Attack Command and Control System (E-4)
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Strategic deterrent credibility depends in part on the existence of a reliable and survivable command and control system. The airborne command post system provides the most survivable element of our current strategic command and control capability due to the mobility of its airborne platforms. To be effective, the airborne platforms must not only survive but be able to perform their mission of message dissemination and force management in an environment including the presence of electromagnetic pulses and electronic jamming. The objective of the E-4 Program is to develop and acquire the E-4B system to provide the National Command Authorities and the Strategic Air Command a highly survivable airborne command post to insure adequate command and control capabilities during all phases of a general war. The EC-135 airborne command posts formerly used by the National Command Authorities and currently used by the Strategic Air Command are considered inadequate due to their lack of nuclear effects hardening, insufficient floor space to house the requisite battlestaff and limited capacity to accept new or additional communication capabilities. In December 1971, the Worldwide Military Command and Control System Council, chaired by the Deputy Secretary of Defense approved the Advanced Airborne Command Post Program to replace selected EC-135 Airborne Command Posts with larger and more capable 747 aircraft. Initiation and guidance for Block I of the E-4 program was received in a Deputy Secretary of Defense memorandum dated 19 January 1973. The E-4B Airborne Advanced Command Post provides a large increase in floor space, seating, and payload capacity. Its communications capability represents a significant improvement in capability - to include a high speed data terminal; a high-power, low frequency radio system incorporating anti-jam features; increased secure voice capability; and two, satellite communications systems with anti-jam capabilities. The entire aircraft has been hardened to withstand the electromagnetic pulse and radiation effects of nuclear blasts. The overall effect is to greatly improve survivability and connectivity over existing EC-135 airborne command posts. The E-4 program is structured around a block concept. Block I included the procurement of three interim E-4A aircraft, the production of a development E-4B, the retrofit of the three E-4A aircraft to a standard E-4B configuration and the procurement of two additional E-4Bs for a total fleet of six aircraft. Block II provides for the development and integration of new systems to insure compatibility with existing and evolving elements of the Worldwide Military Command and Control System. The Block concept is being reviewed to determine if it is still applicable and effective now that the program has delivered an operational aircraft and specific compatibility improvements have been defined.

(U) RELATED ACTIVITIES: Strategic Air Command Communications, Program Element 11316F; Air Force Satellite Communication Program, Program Element 33601F; System Survivability, Program Element 64711F; Electromagnetic Radiation Test Facilities, Program Element 64747F; National Emergency Airborne Command Post, Program Element 32015F; Air Force Support to Minimum Essential Emergency Communications Network, Program Element 33131F; the Defense Support Program, Program Element 12431F; Advanced Computer Technology, Program Element 63728F; and Worldwide Military Command and Control System Automated Data Processing/E-4, Program Element 32010F.

(U) WORK PERFORMED BY: The Air Force Systems Command, Electronic Systems Division, L. G. Hanscom AFB, MA., has responsibilities for the program. The Boeing Company, Seattle, WA., was the prime contractor for the development of the E-4B. The contract for modification of the E-4As to the E-4B configuration was awarded to the Boeing Company, Seattle, WA with E-Systems, Greenville, TX being a major subcontractor.

Program Element: #11312F

DOD Mission Area: Strategic Command and Control, #131

Title: Post Attack Command and Control System (E-4)

Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Studies in the early 1970s investigated numerous alternatives to assist in defining an Advanced Airborne Command Post program. A Block and phase concept was selected with Block I being the production of baseline Advanced Airborne Command Posts and Block II being the addition of growth items. The first phase consisted of the purchase of three Boeing 747 aircraft and their modification to an Interim Airborne Command Post configuration by transferring the command, control and communications equipments from EC-135 aircraft. This effort was accomplished by E-Systems of Greenville, TX and was completed with the delivery of the third E-4A to support the National Emergency Airborne Command Post in September of 1975. The second phase of the program was the development of an advanced airborne command post to be designated the E-4B. This phase included the purchase of a fourth 747 aircraft to serve as the test-bed airframe. A contract for this development effort was awarded to The Boeing Company, Seattle, Washington in the third quarter of Fiscal Year 1974. A Critical Design Review for the E-4B was completed in the first quarter of Fiscal Year 1977. Aircraft modifications; development of advanced command, control and communications systems and the integration of these systems into the E-4B were completed in early 1978 and were followed by an extensive Development, Test and Evaluation period which was completed in December of 1978. This was followed by an Initial Operational Test and Evaluation which was completed in February of 1979. The E-4B then underwent electromagnetic pulse testing at Kirtland AFB, NM, and was returned to the Boeing Company for aircraft refurbishment. Refurbishment of the E-4B was completed in October 1979. An additional period of Development Test and Evaluation and Initial Operational Test and Evaluation occurred between October and December 1979 to verify performance of new systems and to evaluate deficiency correction. The E-4B was delivered to the Air Force on 21 December 1979 and was transferred to the Strategic Air Command on 7 January 1980 for operational use. The Defense System Acquisition Review Council Milestone III Briefing was held on 1 May 1980 resulting in a Decision Memorandum dated 5 June 1980 allowing the program to proceed. A contract for retrofit of the first E-4A to the E-4B configuration was awarded on 26 June 1980.
2. (U) FY 1981 Program: Completes the retrofit demodification engineering started in fiscal year 1980 and effectively completes the development program for Block I. Provides contractor support services for the first E-4B and supports the program office for the completion of the development phase. Provides a limited planning effort to prepare for the integration of directed Block II systems. Directed Block II systems include Automated Data Processing (developed under a separate program), Single Channel Transponder injection capability, multichannel Super High Frequency Satellite System, new High Frequency radios and improved low frequency reception equipment. Initiates retrofit of the second E-4A to the E-4B configuration.
3. (U) FY 1982 Planned Program: Continues the contractor support services for the first E-4B and begins planning, development and engineering for directed Block II systems and provides for a level of effort planning task to insure continued compatibility with the evolving Worldwide Military Command and Control System. Initiates retrofit of the third E-4A to the E-4B configuration. Increased research and development funding estimates are a result of initiation of Block II development. Procurement differences result from obtaining actual contract prices. These prices place a larger share of the total retrofit cost in Operations and Maintenance, equipment installation funds than originally estimated.

Program Element: #11312F

DOD Mission Area: Strategic Command and Control, #131

Title: Post Attack Command and Control System (E-4)

Budget Activity: Strategic Programs, #3

4. (U) FY 1983 Planned Program: Continues development efforts for Block II systems and begins procurement of equipments. Continues level of effort planning and engineering task to insure compatibility with evolving worldwide Military Command and Control System. Initiates procurement of the first production E-4B.
5. (U) Program to Completion: Continues Block II efforts and continues to provide planning and engineering to insure compatibility with the evolving Worldwide Military Command and Control System. Initiates procurement of one more production E-4B in fiscal year 1984. The reduction in procurement funding is the result of a one year acceleration in the procurement of the production aircraft.

6. (U) Milestones:

	<u>Date</u>
A. Contract Award (aircraft #1 & 2 mods)	February 1973
B. Equipment Transfer Contract Award	May 1973
C. Contract Award (aircraft #3)	July 1973
D. Contract Award (aircraft #4 test bed)	December 1973
E. Interim National Emergency Airborne Command Post	
F. Final Operational Capability (3 aircraft)	September 1975
G. Special Defense Systems Acquisition Review Council	October 1975
H. Development Test and Evaluation Complete	December 1978
I. Initial Operational Test and Evaluation Complete	February 1979
J. Delivery of test-bed E-4B to Strategic Air Command (Initial Operational Capability)	January 1980
K. Defense Systems Acquisition Review Council Milestone III decision	June 1980
L. Contract Award for first retrofit with options for future years	June 1980
M. Initiate Retrofit of Second E-4A to E-4B	October 1980
N. Initiate Retrofit of Third E-4A to E-4B	October 1981
O. Initiate Production of E-4B #5	October 1982
P. Initiate Production of E-4B #6	October 1983
Q. Full Operational Capability (six E-4Bs)	July 1987
Future Block Program	Continuing

(U) Explanation of Milestone Changes: The four month delay in the Defense Systems Acquisition Review Council was the result of waiting for source selection to be completed before holding the Milestone III briefing. This also accounts for the delay in initial contract award. The changes in the dates for aircraft number five and six and for the final operational capability are the result of an acquisition strategy that does not have a one year gap between retrofit of the third E-4A and procurement of the number five E-4B. The acquisition plan now provides for a retrofit in fiscal year 1980, 1981 and 1982 and production E-4Bs in fiscal year 1983 and 1984.

Budget Activity: Strategic Programs, #3

Program Element: #11312F, Post Attack Command and Control System (E-4)

Test and Evaluation Data

1. (U) Development Test and Evaluation: Phase 1A - Modification of the first airframe with the Interim Command Control and Communications was completed in September 1974 by E-Systems, Greenville, TX. Development Test and Evaluation and Initial Operational Test and Evaluation were completed in December 1974. Federal Aviation Administration recertification of the aircraft was accomplished. The installed Command Control and Communications mission equipment was removed from the EC-135 National Emergency Airborne Command Post aircraft. Development Test and Evaluation of this equipment included electromagnetic interference and compromising emanations investigation as well as total system evaluation. The second and third aircraft were delivered for operational use after two months of acceptance testing.

(U) Phase 1B - The E-4B Development Test and Evaluation program concentrated primarily on the integration and installation of the advanced command control and communications package and subsequent system level testing of the operational aircraft. Testing of the Boeing 747 airframe with structural modifications (including in-flight refueling, antenna mountings, new aircraft generators) was also accomplished to maintain Federal Aviation Administration certification. In addition, low level electromagnetic pulse tests were conducted on the E-4A type airframe to assist in evaluation of later testing of the electromagnetic pulse hardened E-4B system. Development Test and Evaluation of the advanced command control and communications package was initiated in early 1977 with the pretesting of selected components and subsystems by the prime development contractor, the Boeing Company, Seattle, WA. Initial aircraft testing, both ground and airborne, was accomplished during the latter part of 1977 by the major subcontractor, E-Systems of Greenville, TX after installation of equipment racks, wiring, fixtures, environmental control system, and selected mission equipment. The testing at E-Systems verified the aircraft modifications and substantiated the performance of selected mission subsystems.

(U) Systems Level Test - The testbed aircraft was delivered to the Boeing Plant in January 1978 for installation of the Super High Frequency Satellite Communications terminal, antenna radome, and the Very Low Frequency/Low Frequency communications subsystem. System level ground tests began in February 1978 and airborne tests of the system began in June 1978. Special test instrumentation, which was used to verify specification of performance, was removed from the aircraft in September 1978 prior to starting the final operational verification of the total airborne system. Development Test and Evaluation was concluded on 17 December 1978 after completing a total of forty test flights. A system level electromagnetic pulse test was conducted between February and June of 1979 at Kirtland Air Force Base, New Mexico. Additional ground and airborne tests were conducted between October and December 1979. These tests were to verify performance of systems added during refurbishment such as a new satellite terminal and an improved low frequency communications system. This final phase of Development Test and Evaluation was concluded on 15 December 1979 with a total of eight flights. The E-4B was delivered to the Air Force on 21 December 1979 and turned over to the Strategic Air Command for operational use on 7 January 1980. While some problems were discovered during this extensive Development Test and Evaluation, the problems were resolved and subsequent testing has verified that the E-4B performs in accordance with system specifications.

Budget Activity: Strategic Programs, #3

Program Element: #11312F, Post Attack Command and Control System (E-4)

(U) Phase 1C - With the exception of Electromagnetic Pulse testing, no significant Development Test and Evaluation will be required during this phase; however, acceptance testing of all aircraft will be accomplished after installation of the advanced command control and communications configuration. The Defense System Acquisition Review Council III Decision Memorandum of 5 June 1980 approved production of the E-48. It also directed additional Electromagnetic pulse testing be conducted to take advantage of improved test facilities and methodology over what was available at the time of the original system level electromagnetic pulse test. The feasibility of conducting additional electromagnetic pulse testing in 1982 is being investigated.

2. (U) Operational Test and Evaluation: The operational test and evaluation of the E-4 is being conducted in phases as appropriate for the various phases of the E-4 program. The testing phases with the test objectives and the results (if completed) are as follows:

(U) An Initial Operational Test and Evaluation of the E-4A was conducted by Headquarters Command and the Organization of the Joint Chiefs of Staff on the first Phase 1A interim aircraft at Andrews Air Force Base, Maryland, in December 1974. The primary objective of that Initial Operational Test and Evaluation was to determine if the E-4A could effectively perform the National Emergency Airborne Command Post mission and be operated and maintained using existing assigned personnel, interim base facilities, and contractor logistics support. Upon completion of Initial Operational Test and Evaluation, it was concluded that the E-4A system could perform the basic National Emergency Airborne Command Post mission while being operated and maintained as planned.

(U) Initial Operational Test and Evaluation of the Phase 1B test bed E-48 aircraft, conducted by the Air Force Test and Evaluation Center, began in combination with Development Test and Evaluation ground tests at E-Systems from September to December 1977. It continued from January through December 1978 as part of the combined Development Test and Evaluation and Initial Operational Test and Evaluation at The Boeing Company in Seattle, WA. A 47-day separate Initial Operational Test and Evaluation beginning 27 December 1978 at Offutt Air Force Base, NE, followed the combined Development Test and Evaluation/Initial Operational Test and Evaluation. The separate Initial Operational Test and Evaluation testing included 13 flights (125.7 hours) in the operational environment with deployments to Andrews Air Force Base, MD, (the National Emergency Airborne Command Post forward operating base) for ground alert evaluation and to Howard Air Force Base, Canal Zone, for hot weather self-sustained ground alert evaluation. During this test period, the E-48 participated in both a Joint Chiefs of Staff POLO MAT exercise and a Strategic Air Command GIANT STAFF exercise. These exercises closely simulated the operational environment, and allowed a side-by-side comparison with currently operational aircraft, the E-4A and EC-135. During the separate Initial Operational Test and Evaluation the aircraft was operated and maintained by Air Force personnel from the Strategic Air Command, Office of the Joint Chiefs of Staff, and Air Force Communications Command. The separate Initial Operational Test and Evaluation was completed on 11 February 1979 with a test flight that delivered the aircraft to Kirtland Air Force Base, New Mexico, for start of the system-level electromagnetic pulse Development Test and Evaluation Testing at the Air Force Weapons Laboratory.

Budget Activity: Strategic Programs, #3

Program Element: #11312F, Post Attack Command and Control System (E-4)

(U) The Initial Operational Test and Evaluation test team was composed of personnel from the Air Force Test and Evaluation Center, Air Force Logistics Command, Air Force Systems Command, Air Training Command, Air Force Communications Command, Strategic Air Command, Office of Joint Chiefs of Staff, Air Force Security Service, and the School of Aerospace Medicine. The operational mission requirements of both the Strategic Air Command and the Office of Joint Chiefs of Staff/National Emergency Airborne Command Post served as the basis for the evaluation. Major objectives were to estimate operational effectiveness and suitability, and to identify deficiencies.

(U) As a result of the Initial Operational Test and Evaluation, it was concluded that the E-4B aircraft will provide an improved command, control, and communications capability for the airborne command post missions of the Joint Chiefs of Staff and the Strategic Air Command. The test bed aircraft, as configured during Initial Operational Test and Evaluation, demonstrated satisfactory operational effectiveness, but was deficient in reliability, maintainability and availability. Test results are contained in the Advanced Airborne Command Post (E-4B) Initial Operational Test and Evaluation Final Report(S) dated November 1979.

(U) Operational deficiencies were discovered in certain subsystems during the Initial Operational Test and Evaluation phase; however extensive efforts were taken to correct these deficiencies. Appropriate fixes were incorporated for the majority of these problems during the aircraft refurbishment phase, and resolution of any remaining problems is being accomplished as engineering solutions are developed. In addition, several new subsystems were installed during this same refurbishment period to attain the production configuration. Following the successful completion of the postrefurbishment testing, Air Force Test and Evaluation Center found the operational effectiveness to be satisfactory and projected the operational suitability (reliability, maintainability, and availability) to be satisfactory based on satisfactory correction of several deficiencies in the suitability area. Postrefurbishment test results are contained in the Advanced Airborne Command Post (E-4B) Initial Operational Test and Evaluation Final Report Annex A (S) dated May 1980.

(U) A Follow-on Operational Test and Evaluation for the E-4B is being conducted by the Strategic Air Command and Office of the Joint Chiefs of Staff from May 1980 through September 1981. The purpose of the Followon Operational Test and Evaluation is to refine initial operational suitability and operational effectiveness estimates and to verify correction of operational deficiencies identified during Initial Operational Test and Evaluation. Air Force Test and Evaluation Center will monitor the Followon Operational Test and Evaluation.

Budget Activity: Strategic Programs, #3

Program Element: #11312F, Post Attack Command and Control System (E-4)

3. (U) System Characteristics: The significant E-4b performance objectives and demonstrated performance are shown below. All objectives were demonstrated during Development Test and Evaluation.

	Objective 12	Demonstrated Performance 12
(U) Operational		
Unrefueled Time on Station (hours)		
Maximum Payload (pounds) (E-4B)	150,000	150,000
Maximum Personnel Complement	94	94
Maximum Gross Taxi Weight (pounds) (E-4B)	803,000	803,000
Maximum Take-off Thrust (pounds)	201,400	201,400
(U) Technical		
Electrical Power (Kilo Volt Amperes)	1200	1200
Ultra High Frequency Satellite Communications		
a. Bandwidth (Kilo Hertz)	5	5
b. Bit Error Rate/Bits Per Second	10 ⁻³ /75	10 ⁻³ /75*
Super High Frequency Satellite Communications (Bit Error Rate/Bits Per Second)	10 ⁻³ /75 10 ⁻⁶ /1200 10 ⁻⁵ /2400 10 ⁻³ /9600	10 ⁻³ /75* 10 ⁻⁶ /1200* 10 ⁻⁵ /2400* 10 ⁻³ /9600*
Command Radio Power (Watts)	30	30
Automatic Switching System Connections (Lines)	111	111
Automatic Digital Network Terminal (Bit Error Rate/Bits Per Second)	10 ⁻⁵ /2400	10 ⁻⁵ /2400*
Low Frequency/Very Low Frequency Power Output (Kilo Watts)	200	200*

*Meets or exceeds contractual guarantees

Project Number: #2212

Program Element: #11312F

DOD Mission Area: Strategic Command and Control, #131

Title: E-4 Block II

Title: Post Attack Command and Control System (E-4)

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Block II of the E-4 program will insure that the E-4 maintains compatibility with existing and evolving elements of the Worldwide Military Command and Control System, update logistically outdated equipment and provide improved capabilities. The command, control, and communications environment is continually evolving to meet new threats or increased threats, improve connectivities, and streamline operations. A key to any command, control, and communications system is that the various elements must be compatible with each other. Block II represents a number of initiatives already defined and others yet to be defined to insure that the E-4 maintains the requisite compatibility with other elements of the Worldwide Military Command and Control System. Currently planned items within Block II are Automated Data Processing, replacement High Frequency Radios, multiple Super High Frequency satellite channels, improved Low Frequency receive capability, and a Single Channel Transponder message injection capability. The Block concept is being reviewed to determine if it is still applicable and effective now that the program has delivered an operational aircraft and has proceeded into a production program.

(U) RELATED ACTIVITIES: Strategic Air Command Communications, Program Element 11316F; Air Force Satellite Communication Program, Program Element 33601F; System Survivability, Program Element 64711F; Electromagnetic Radiation Test Facilities, PE 64747F; National Emergency Airborne Command Post, Program Element 32015F; Air Force Support to Minimum Essential Emergency Communications Network, Program Element 33131F; the Defense Support Program, Program Element 12431F; Advanced Computer Technology, Program Element 63728F; and Worldwide Military Command and Control System Automated Data Processing/E-4, Program Element 32010F.

(U) WORK PERFORMED BY: Block II efforts will be implemented in different ways. The Automated Data Processing System is being developed through the Air Force Logistics Command, Worldwide Airborne Command Post Program Office, Tinker Air Force Base, OK, and will be a contractor effort. The Air Force Systems Command, Electronic Systems Division, Hanscom Air Force Base, MA, has responsibility for the E-4 program and will also acquire Block II items through the prime retrofit contractor, the Boeing Company, Seattle, WA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In September 1980, a Joint User Prioritized List for the E-4 was signed by the Chairman of the Joint Chiefs of Staff. This list serves as the departure point for acquiring systems necessary to insure E-4 compatibility. Additional studies by the Defense Communications Agency have provided other candidate items for consideration. Initial selection of items for Block II implementation was made based on requirements, logistics considerations and technology. These items are Automated Data Processing, Multiple Super High Frequency satellite channels, improved Low Frequency receive capability, replacement High Frequency radios, and a Single Channel Transponder injection capability.

Project Number: #2212

Program Element: #11312F

DOD Mission Area: Strategic Command and Control, #131

Title: E-4 Block II

Title: Post Attack Command and Control System (E-4)

Budget Activity: Strategic Programs, #3

2. (U) FY 1981 Program: A limited planning effort to prepare for the development and integration of directed Block II systems will be accomplished. In addition other candidate systems from the Joint User Priority List will be surveyed for future implementation efforts. Directed Block II systems are an Automated Data Processing capability (developed under a separate program), a multiple channel Super High Frequency satellite communications capability, replacement High Frequency radios, improved Low Frequency reception equipment and a Single Channel Transponder injection capability.

3. (U) FY 1982 Program: Begins development and engineering tasks to provide for the integration of directed Block II systems. Continues a level of effort planning task to insure continued compatibility with the evolving Worldwide Military Command and Control System.

4. (U) FY 1983 Program: Continues tasks necessary for implementation of Block II items and to maintain E-4 compatibility. Begins installation of Block II systems in-line with production aircraft.

5. (U) Program to Completion: Block II will continue as the need to maintain compatibility of the E-4 with the Worldwide Military Command and Control System will continue. As systems are identified for the E-4, the necessary development and planning will be accomplished and implementation methods selected.

6. (U) Milestones:

A. Joint User Prioritized List

B. Initial Implementation Plan

Date

September 1980

January 1981

7. (U) RESOURCES (\$ in Thousands):

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Cost
Procurement (Aircraft)	3,500	800	6,200 800	3,700 7,700	Continuing Continuing	N/A N/A

8. (U) COMPARISON WITH FY81 BUDGET DATA:

Procurement (Aircraft)	4,400	1,100 800	4,000 2,800	Continuing Continuing	N/A N/A
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The increased Research Development Test and Evaluation funding in fiscal year 1982 results from a detailed review of Block II tasks and the development required to integrate these items into the E-4B. Similar integration efforts accomplished during aircraft refurbishment provided a basis for developing this revised estimate. Procurement funding in fiscal year 1983 represents initial estimates of the costs to procure Block II kits.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #11316F

Title: SAC Communications

DoD Mission Area: Strategic Communications #133

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
1136	SAC Digital Network	17,000	23,000	30,100	2,500	800	118,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Strategic Air Command Digital Network Program will upgrade and modernize the Strategic Air Command's printed copy command and control communications system. The specific objectives are to: (1) provide two-way, direct, secure communications with enhanced survivability from the National Command Authorities and the Commander-in-Chief Strategic Air Command to dispersed missile crew commanders and aircraft wing commanders; (2) provide the capacity and flexibility to interface with other planned systems; (3) provide growth potential to support future printed copy requirements; and (4) replace existing command and control data transmission subsystem which uses 1950's technology.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Prototype hardware and software development will be completed. Phase I system testing will be complete prior to authorizing a low rate initial production in second quarter, FY 1982. Field Development Test and Evaluation/Initial Operational Test and Evaluation will begin. Preparation will begin for the Air Force Systems Acquisition Review Council assessment in FY 1983 prior to entering into full production. Cost estimates are based on a cost analysis completed by Electronic Systems Division in June 1980 and subsequently reviewed by Headquarters, Air Force.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	17,000	23,100	28,800	2,900		114,500
Procurement, Other (Quantity)				160,400* (193)		160,400* (193)

(U) OTHER APPROPRIATION FUNDS:

Procurement, Other (Quantity)	25,500 (20)	102,000 (173)	5,500	133,000 (193)	

*Includes initial spares

Project: #1136

Program Element: #11316F

DoD Mission Area: Strategic Communications, #133

Title: SAC Digital Network

Title: SAC Communications

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Strategic Air Command Digital Network Program includes the design, acquisition and implementation of a command and control data communications system for the Commander-in-Chief Strategic Air Command. The system will significantly improve current communications capabilities from both operational and maintenance standpoints. The Strategic Air Command Digital Network will replace the Strategic Air Command Automated Total Information Network I computer and key elements of the Data Transmission Subsystem of Strategic Air Command's Automated Command Control System. It will interface with the Strategic Air Command Automated Command Control System Data Display Subsystem. International Telephone and Telegraph Corporation is the prime contractor with total system performance responsibility. Maximum use will be made of off-the-shelf equipment. Modifications to hardware and new hardware/software procurement will be made only where operational requirements dictate. Minimum changes to present equipment will be made to meet the presently defined and validated operational requirements.

(U) RELATED ACTIVITIES: Program Elements 11212F and 11213F will accomplish Strategic Air Command Digital Network integration into the Titan II and Minuteman Weapons Systems. Automatic Digital Network II (Program Element 33126F, Defense Communications System Long Haul Communications) provides major network trunking support for the Strategic Air Command Digital Network.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom Air Force Base, MA, for total program management; MITRE Corporation, Bedford, MA, for technical support; Air Force Weapons Laboratory for electromagnetic pulse criteria, analysis and testing; Rome Air Development Center for reliability testing and Automatic Voice Network and Automatic Digital Network II acceptance criteria; Air Force Test and Evaluation Center for Initial Operational Test and Evaluation, and International Telephone and Telegraph, Defense Communications Division, Nutley, NJ, as prime contractor. The Air Force Communications Command will develop application software.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A Strategic Air Command Total Information Network IV contract was awarded to International Telephone and Telegraph on 15 March 1977 to upgrade the Strategic Air Command Automated Command Control System system; however, the House/Senate Defense Appropriations Conference deleted the Strategic Air Command Total Information Network IV Program in its review of the FY 1978 budget in August 1977. Congress agreed that a valid need existed for an improved Strategic Air Command Communications System and encouraged the Air Force to restudy its needs and to resubmit to Congress a less expensive system with greater use of standard equipment and non-dedicated circuits. An Air Force conducted redefinition was accomplished, and \$1.999 million of FY 1977 RDT&E funds was reprogrammed to continue the detailed redefinition to obtain cost, schedule and technical information from the contractor. The program redefinition, which satisfied the concerns of Congress and the defined and validated communications requirement of the Strategic Air Command, was completed in January 1978. The January 1978 Air Force Systems Acquisition Review Council approved the restructured program and recommended reprogramming \$8.5M of FY 1978 funds. Congressional approval was obtained in June 1978. In FY 1978 and FY 1979, the System Design Review was conducted and the contractor

Project: #1136

Program Element: #11316P

DoD Mission Area: Strategic Communications, #133

Title: SAC Digital Network - SACDIN

Title: SAC Communications

Budget Activity: Strategic Programs, #3

began the prototype development effort, including development of the communications processor. This processor will meet stringent security and environmental requirements of the Strategic Air Command and will be the heart of the Strategic Air Command Digital Network terminal at 193 SAC missile and aircraft locations. Other prototype hardware, primarily off-the-shelf, was also ordered during FY 1979. Concurrent with the hardware efforts, the contractor initiated a total software design effort. Initial efforts were aimed at developing a software mechanism to ensure system security. Software Development, Test and Evaluation was started during FY 1980 while the start of hardware Development Test and Evaluation was rescheduled for the beginning of FY 1981. Hardware design continued as planned in FY 1980 with fabrication of the prototype equipment delayed due to a budgetary reduction. This rephasing was accomplished without impact to the System Development Test and Evaluation scheduled for the end of FY 1981. The development of some Computer Program Configuration Items was completed during FY 1980 and development continued on others. Adjustment of some software development was also necessary to react to the FY 1980 shortfall; however, major schedule milestones were not affected.

2. (U) FY 1981 Program: During FY 1981, additional functional prototype hardware will be fabricated, assembled, and integrated to reflect all combinations of operational configurations. Testing will be performed on the assembled racks to verify that the equipment meets its functional, environmental, and electromagnetic compatibility/security requirements. The software effort for the functional prototype will be essentially completed and the software will be used in system level integration testing with hardware. This will ensure that the functional prototype has, in fact, reduced or eliminated the technical risks identified with the development program. Contract award for the second phase of the program is anticipated in the second quarter of FY 1981.

3. (U) FY 1982 Planned Program: In FY 1982, the prototype system development, including the software, will be completed, as well as contractor conducted Development, Test, and Evaluation. Field Development Test and Evaluation/Initial Operational Test and Evaluation will begin. Preparations will be made for an Air Force Systems Acquisition Review Council III, scheduled for January-April 1983.

4. (U) FY 1983 Planned Program: Field Initial Operational Test and Evaluation will be completed in the first quarter of FY 1983. The Air Force Systems Acquisition Review Council III review process will commence in January and run through April with production scheduled to begin thereafter.

5. (U) Program to Completion: Significant RDT&E funding activity ends in FY 1983 with completion of Initial Operational Test and Evaluation. The production option, aimed at achieving a full operational capability in January of 1985, will be exercised following an Air Force Systems Acquisition Review Council III review. The program for FY 1984 and FY 1985, therefore, will encompass end item production delivery, installation and transition to full operation.

6. (U) Milestones:

- A. Program Redefinition Complete/
Air Force Acquisition Review Council Approval
- B. Congress Approved Reprogramming
- C. Contract Date

January 1978

June 1978

July 1978

543
543
690

Project: #1136

Program Element: #11316F

DoD Mission Area: Strategic Communications, #133

- D. Restart Work
- E. Start In-Plant Test and Evaluation
- F. Program Review (Secretary of the Air Force)/
Start Phase II Follow-on Research and Development
- G. Program Review (Secretary of the Air Force)
- H. Start Field Development Test and Evaluation/
Initial Operational Test and Evaluation
- I. Air Force Systems Acquisition Review Council III
- J. Production Decision/Contract Option Award
- K. Final Operational Capability

Title: SAC Digital Network - SACDIN

Title: SAC Communications

Budget Activity: Strategic Programs, #3

August 1978

October 1980

March 1981

December 1981

February 1982

January-April 1983

April 1983

January 1985

44
544
101

Budget Activity: #3 Strategic Programs

Program Element: 11316F, Strategic Air Command Digital Network

Test and Evaluation Data

1. (U) Development Test and Evaluation: During the development phase, Strategic Air Command Digital Network Tests will include response time, accuracy, and human factors. After the individual subsystems are fabricated, the subsystems will be assembled into a prototype of the Strategic Air Command Digital Network. This prototype will be tested to determine the accuracy, response, hardness, and security characteristics and to insure that the subsystems properly function together. Simulation will be used to exercise the prototype during system tests. The Development Test and Evaluation testing period will last from approximately the fourth quarter, fiscal year 1979 to the second quarter, fiscal year 1982. International Telephone & Telegraph (ITT) Defense Communications Division, Nutley, NJ, is the Prime Contractor.

(U) The prototype will consist of the same hardware as production units (keyboards, printer, processors). In addition the prototype will contain hardened equipment for the Intercontinental Ballistic Missile Launch Control Centers that is also the same as the production equipment. After in-plant testing, Strategic Air Command Digital Network equipment will be installed at Offutt Air Force Base and Vandenberg Air Force Base and Development Test and Evaluation will be conducted using the actual external interfaces. Reliability and Maintainability testing will be conducted. All Development Test and Evaluation will be completed prior to the production decision. Acceptance testing and checkout will be conducted during production and deployment

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center will conduct Initial Operational Test and Evaluation of the Strategic Air Command Digital Network equipment installed at Strategic Air Command operational locations (Offutt Air Force Base, Vandenberg Air Force Base, and the contractor's plant, International Business Machines Gaithersburg, MD), and the Air Force Communications Computer Programming Center. There will be 60 days of separate Initial Operational Test and Evaluation (November and December 1982). The Air Force Test and Evaluation Center test team will use the test network to run exercises simulating Strategic Air Command operational communications and to evaluate the Strategic Air Command Digital Network operational effectiveness and suitability. Objectives will include system performance, system control, interoperability, human interface, safety, electromagnetic compatibility, and security to the extent allowed by the prototype configuration. The test team will consist of people from the Air Force Test and Evaluation Center, Strategic Air Command, Air Force Communications Command, Air Force Communications Computer Programming Center, Air Force Logistics Command, Electronic Security Command, and the National Security Agency. In addition to conducting separate Initial Operational Test and Evaluation, the test team will participate in and observe the contractor's Development Test and Evaluation efforts from June 1981 to October 1982. Data gathered during the Development Test and Evaluation tests will also be used to meet Initial Operational Test and Evaluation objectives as appropriate. Air Force Systems Acquisition Review Council review is scheduled for April 1983.

Budget Activity: #3 Strategic Programs

Program Element: 11316F, Strategic Air Command Digital Network

3. (U) Systems Characteristics

<u>CHARACTERISTIC</u>	<u>OBJECTIVE</u>	<u>DEMONSTRATED</u>
Response time:		
Transmit Emergency Action Message	15 Seconds	(99.9 percent confidence) To be determined
Low Precedence Traffic	60 Seconds	(70 percent confidence)
Accuracy:		
Undetected Character Errors	1:10 ⁸	
Availability:		
Minuteman Path (7 hours per year)	0.999195	
TITAN Path (14.5 hours per year)	0.998214	
Maintainability:		
Mean Time to Repair (Organizational)	15 Minutes	
Mean Time Between Maintenance		
Missile Base Communications Processor	1125 Hours	
Hard User Terminal Element	2250 Hours	
Security:		
To the Executing Commanders	Multilevel Secure	
Traffic:		
Peak Load at Offutt Switch	11 Million Characters/Hour	
Flexibility:		
	Manual Reconfiguration	
Hardness:		
For Hard Installation	Consistent with installation/location in the missile weapon system launch control center.	
Growth:		
Hardware & Software	Modular Design.	

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12310F

DOD Mission Area: Strategic Communications, #133

Title: WMCCSC ADP - NORAD/ADCOM

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
				2400	TBD	TBD	TBD
TOTAL FOR PROGRAM ELEMENT							

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The World Wide Military Command and Control System Automatic Data Processing - NORAD/ADCOM program initiates actions to upgrade the Communications System Segment of CINCNORAD's 427M Command and Control system. The existing Communications System Segment, even considering provide reliable warning and assessment of aerospace attacks on North America in the 1985 time-frame.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Provides funds for a competitive concept development contract for a distributed processor computer system to perform the NORAD Cheyenne Mountain Complex's communications processing tasks. Estimated costs consider competitive run-off between at least two contractors and are based on similar recent concept definition studies.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (other)
Operations and Maintenance

FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
		2800	TBD	TBD	TBD
		800	TBD	TBD	TBD

Program Element: #12310F

DOD Mission Area: Strategic Communications, #133

Title: WMCCS ADP - NORAD/ADCOM

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The NORAD Cheyenne Mountain Complex is the centralized command and control center supporting the NORAD/ADCOM/ADC mission. This facility operates a variety of computer systems, acquired under program 427M, which are the primary means of achieving required mission capabilities. The Communications System Segment is the computer system that provides the communications for 427M and integrates the individual components into a cohesive system. The Communications System Segment provides essential communications support for the tactical warning and attack assessment mission and the space defense mission by handling complete message processing, formatting, line code conversion and the routing of internal and external user messages. The Communications System Segment interfaces with essentially all external facilities serving or served by the NORAD Cheyenne Mountain Complex. As such, it is the single most critical element in the NORAD computer suite.

CINCNORAD's ability to provide reliable warning and assessment of aerospace attack - Included in these problems is its large, complex, monolithic and highly interconnected hardware and software structure. This has,

Additionally, the current Communications System Segment

(U) RELATED ACTIVITIES: As the communications hub for the NORAD Cheyenne Mountain Complex, the Communications System Segment interfaces with virtually all surveillance and/or warning systems. These interfaces are, however, clearly defined and should result in little impact among systems.

(U) WORK PERFORMED BY: TED

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable
2. (U) FY 1981 Program: Not Applicable
3. (U) FY 1982 Planned Program: Competitive concept definition contracts will be negotiated to develop a design concept for a 427M Communications System Segment replacement. Design solution should include state of the art hardware and software and should consider provisions to encourage modularity of both hardware and software, provide automatic fault recovery or fail-soft operation, and provide techniques to enhance error isolation and more readily permit changes and improvements to the computer data base and program.
4. (U) FY 1983 Planned Program: Not Applicable
5. (U) Program to Completion: Not Applicable
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12311P

Title: NORAD Combat Operations Center/Space
Defense Operations Center
Budget Activity: Strategic Programs, #3

DoD Mission Area: Strategic Information Systems, #134

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

<u>Project Number</u>	<u>Title</u>	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	TOTAL FOR PROGRAM ELEMENT	5875	16000	24100	27600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the Space Defense Command and Control System consisting of a Space Defense Operations Center and the necessary communications systems. The Space Defense Command and Control System is required to satisfy Presidential and Secretary of Defense directives to improve, in a balanced manner, the space defense capabilities of the United States. This program will develop the Space Defense Command and Control System in a phased approach to support the evolving space defense capabilities of the United States.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Fiscal 1982 funds will continue efforts on the anti-satellite Prototype Mission Operations Center, including development of hardware and software. Also, the Space Defense Operations Center Phase IV procurement will be initiated. The Command and Control support for the defensive countermeasures demonstration will be integrated into the Space Defense Operations Center operations. The Fiscal 1982 requirements were generated as the result of a contractor assessment.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

<u>RDT&E</u>	<u>FY 1980</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	5000	16000	22500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

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Program Element: #12311P

Title: NORAD Combat Operations Center/ Space
Defense Operations Center
Budget Activity: Strategic Programs, #3

DoD Mission Area: Strategic Information Systems, #134

DETAILED BACKGROUND AND DESCRIPTION:

To remedy this shortfall, the Air Force is aggressively improving and developing space defense capabilities including: Space Surveillance Systems, Satellite Survivability Systems, and anti-satellite systems. For these elements to be operationally employed in an integrated and coordinated manner, an effective command and control system is essential.

During both peace and conflict, United States military operations will require assessment of the situation in space, its impact on terrestrial forces and the ability of the National Command Authorities to respond rapidly to changes in that situation. Responses to a changing situation might include: increasing the Defense Condition, notifying satellite users and operators of impending attack, maneuvering satellites, launching an anti-satellite weapon or launching a replacement satellite. The selection of which of these responses is appropriate is dependent on a fully integrated command and control system, usable in both peacetime and under stressed conditions. Effective command and control is the key to meeting any potential threat in space.

A program was initiated in Fiscal Year 1978 for the phased development of the Space Defense Operations Center. Phase I was initiated 1 Oct 1979 using existing North American Air Defense Command Combat Operations Center resources. In the future, a number of incremental improvements

will be incorporated into ongoing space defense operations as they become available. A Prototype Mission Operations Center is being developed to support the development and operational testing of the Minia-ture Air-launched Anti-satellite system. This mission operations center will also provide the command and control for the anti-satellite system operations during the period of limited operational capability. At the time of initial operational capability of the anti-satellite system, the Space Defense Operations Center (Phase IV) will perform all anti-satellite command and control and also all force management. When the Space Defense Center is fully operational

it will plan, coordinate, and advise the National Command Authority of all Space Defense Operations. In turn, it will disseminate decisions/directives of the National Command Authority to the users. Some typical responsibilities of the Space Defense Center include: continuously monitoring United States satellite and ground system status; providing satellite attack warning; reporting hostilities in space as they occur; monitoring satellite interference, verification of data outputs; maintaining status of friendly surveillance assets and their availability for tasking; notifying users of potential critical satellite support loss; providing notification to satellite command and control ground stations during hostilities/disaster; recommending execution of replacement launch; maintaining status of Soviet satellites; planning, coordinating and directing United States anti-satellite operations and providing strike assessment.

(U) RELATED ACTIVITIES: This program is part of a single managed Space Defense Systems Program involving four functional areas: space survivability, space surveillance, anti-satellite, and command and control. Those program elements that are directly related are the following: Program Element 63428F, Space Surveillance Technology; 12424F, SPACETRACK; 63438F, Satellite System Survivability; and 64406F, Space Defense System. Also, the Consolidated Space Operations Center, Program Element 35130, will interface with the Space Defense Operations Center to provide the link between Space Defense Operations and the satellite operators for survivability and warning information.

Program Element: #12311F

DoD Mission Area: Strategic Information Systems, #134

Title: NORAD Combat Operations Center/Space
Defense Operations Center

Budget Activity: Strategic Programs #3

(U) WORK PERFORMED BY: Air Force System Command's Space Division in Los Angeles, CA, is responsible for overall management of the Space Defense Command and Control System development. The Prototype Mission Operations Center is being developed by Boeing, Seattle, WA. Concept definition contractors for the Space Defense Operations Center contract were: Martin Marietta Corporation, Denver, CO, and System Development Corporation, Santa Monica, CA. The actual contract for the Space Defense Operations Center has not yet been let. A request for proposal is scheduled for release in early 1981. The primary support contractors are Science Applications Incorporated, La Jolla, CA, Aerospace Corporation, Los Angeles, CA, and MITRE Corporation, Boston, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Improvements to the North American Air Defense Command's Cheyenne Mountain Complex have been accomplished during the last several years. In 1979, an initial Space Defense Operations Center capability was established at the direction of the Assistant Secretary of Defense (Communications Command Control and Intelligence), using existing resources. Detailed system architecture and conceptual design studies were initiated in Fiscal Year 1978 for the Space Defense Command and Control System addressing the following areas: (1) status data requirements and interfaces for United States satellite elements, (2) information requirements, flows, and interfaces, (3) decision logic sequences and development of option planning, (4) system implementation options/trade-offs and recommended configurational capabilities, (5) survivability and life cycle cost, (6) evolution of the system coupled with a roadmap of increasing capabilities and functions to support improved surveillance systems, satellite attack warning, anti-satellite targeting and warning of Soviet satellite reconnaissance, and (7) a program implementation plan and specifications. These efforts were continued in 1979 and 1980. During Fiscal Year 1980, the Space Defense Operations Center Phase IV architecture was refined and system specifications developed to begin procurement of the system. Also, support to near-term Space Defense Operations Center improvements (SPACETRACK and Satellite Attack Warning/Verification upgrades) was provided.

The system design requirements of the Prototype Mission Operations Center for the Anti-satellite system were established during Fiscal Year 1979. This effort included both the miniature anti-satellite vehicle Development Test and Evaluation/Operational Test and Evaluation, and Limited Operational Capability support requirements. During Fiscal Year 1980, the Mission Operation Center design was finalized and construction of the deliverable hardware and software was begun. This effort is essential for the Prototype Mission Operations Center to be available to support Anti-satellite testing.

2. (U) FY 1981 Program: During Fiscal Year 1981, the Space Defense Operations Center Phase IV procurement will begin. Source selection will be completed and the development contract awarded in late Fiscal Year 1981 and detailed design efforts will begin. These efforts will address software modification requirements, displays, interfaces with existing systems external/internal communications and long-lead hardware items. The foreign launch assessment satellite

Program Element: 12311F

Title: NORAD Combat Operations Center/Space
Defense Operations Center

DoD Mission Area: Strategic Information Systems, #134

Budget Activity: Strategic Programs, #3

attack warning upgrade will also be integrated into the Space Defense Center operations. Additionally in 1981 the Prototype Mission Operations Center hardware/software development and test will continue.

3. FY 1982 Planned Program: Prototype Mission Operations Center development will be completed with anti-satellite test preparations.

The Space Defense Operations Center Phase IV development will be fully underway. The detailed design will be firmed and early subsystem and component building and test will be performed. The command and control support for the defensive countermeasures demonstration will be integrated into the Space Defense operations. The funding for Fiscal Year 1982 reflects only inflation growth from the 1982 figures submitted in the 1981 Descriptive Summary.

4. FY 1983 Planned Program: The completed Prototype Mission Operations Center will support
The Space Defense Operations Center development and deployment will continue during Fiscal Year 1983.

5. Program to Completion:

The Prototype Mission Operations Center will be used to provide command and control during this period. The Space Defense Operations Center development and deployment efforts will continue. The initial operational capability of Phase IV Space Defense Center is planned to be achieved by Fiscal Year 1986. The Space Defense Operations Center is a continuing program.

6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 12325F Title: Joint Surveillance System (JSS)
DOD Mission Area: Strategic Air Defense, #122 Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,688*	9,700	1,357	942	None	45,387

*Reflects recent reprogramming action of -\$62 thousand.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Joint Surveillance System (JSS) is to replace the existing Semi-Automatic Ground Environment (SAGE), Back-up Interceptor Control (BUIC) and manual air defense systems and to provide air surveillance and airspace sovereignty. The objective of this program is large cost avoidance in radar operation and operation center support through the elimination of redundancy in the civilian and military radar nets, and replacement of the SAGE/BUIC systems which are expensive to maintain and operate. The system will use radar data from a single net of Federal Aviation Administration (FAA), USAF and Navy radars in the Continental United States and Alaska to input to FAA Air Route Traffic Control Centers and Air Force Region Operations Control Centers (ROCCs). Two ROCCs will be provided to Canada via Foreign Military Sales.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Emphasis will be placed on integration and testing leading to Initial Operational Capability (IOC) of the first Region Operations Control Center (ROCC) in early 1982. Program Office engineering support will continue. The estimate was provided by the System Program Office (SPO) of Electronic Systems Division (ESD), Hanscom Air Force Base, MA. The quality of the estimate is considered good since it is based on historical experience.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs *
RDT&E	8,600	9,700	1,300		900	48,200
Other Procurement	71,538	1,914	2,154		2,885	127,542

The decrease for JSS in FY 1980 for both RDT&E and Procurement funding resulted from lower than anticipated Engineering Change Proposals (ECPs).

(U) OTHER APPROPRIATION FUNDS:

Other Procurement (Quantity-ROCC)	63,181 (4)	1,940	3,235	2,844	2,760	123,011** (5)
Military Construction	23,200					37,800
Operation and Maintenance	4,797	10,133	21,880	27,593	Continuing	Not Applicable

* Totals include FY 1979 & Prior Funding
** Includes spares

Program Element: # 12325F

DoD Mission Area: Strategic Air Defense Support, #122

Title: Joint Surveillance System (JSS)

Budget Activity: Strategic Program, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Joint Surveillance System (JSS) is to replace the Semi-Automatic Ground Environment/Back-up Interceptor Control (SAGE/BUIC) and manual air defense systems and to provide air surveillance and airspace sovereignty. The objective of this program is cost avoidance of over \$100 million/year in radar operation and operation center support through the elimination of redundancy in the civilian and military radar nets, and replacement of SAGE/BUIC operations centers which are expensive to operate and maintain. The program will implement a system which uses radar data from a single radar net of Federal Aviation Administration (FAA), Air Force and Navy radars in the Continental United States (CONUS) and Alaska as input to the FAA Air Route Traffic Control Centers and Air Force Region Operations Control Centers (ROCCs). JSS will provide four ROCCs in the CONUS and one in Alaska which will be equipped with modern off-the shelf computers, displays, and peripheral equipment to perform surveillance and air sovereignty operations. Canada will install a similar system with two ROCCs acquired through Foreign Military Sales. Although JSS is a low risk program utilizing mainly off-the-shelf components, a large amount of unique computer software development was undertaken. For this reason JSS production was preceded by a seventeen month Design Verification Period (DVP) to minimize any remaining risk. During DVP, the contractor performed the initial design and integration in critical software areas. After verification to insure the technical adequacy of the design, a contract was awarded in June 1979 for acquisition of the ROCC hardware/software during the Implementation Period. Thus, DVP allowed the Air Force to develop confidence that all critical areas have been examined prior to committing procurement funding.

(U) RELATED ACTIVITIES: JSS is related to the SAGE/BUIC systems which it will replace. JSS is also related to the CONUS Over-the-Horizon (OTH-B), Alaskan Minimally Attended Radar Program (SEEK IGLOO PE 12411F), Dew Refurbish (PE 12412F), and the E-3A programs. JSS will provide command and control of air defense forces as the tactical situation dictates for as long as it survives. The E-3A, as the more survivable element of air defense, will provide command and control during wartime. Coordination on all major activities is obtained from Tactical Air Command, Air Force Logistics Command, Alaskan Air Command, and the Air Force Communications Command. Coordination is also obtained from FAA on radar sensor portions of the program. Close coordination is maintained with Canada by having Canadian officers assigned to the Program Office.

(U) WORK PERFORMED BY: Program management is provided by the Electronics System Division of the Air Force Systems Command. The prime contractor is Hughes Aircraft Corporation, Fullerton, CA. Engineering support is provided by Input/Output Computer Sciences, Waltham, MA; Logicon Incorporated, Lexington, MA; MITRE Corporation, Bedford, MA; and Support Systems Associates Inc, Burlington, MA.

Program Element: # 12325P

DoD Mission Area: Strategic Air Defense, #122

Title: Joint Surveillance System (JSS)

Budget Activity: Strategic Programs, #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: FY 1980 funds were utilized for executing the Implementation Period (IP) contract for the remaining US Region Operations Control Centers (ROCCs) awarded 29 October 1979. FY 1979 funds completed the seventeen month DVP contractual effort, commenced the Implementation Period (IP) contract for one ROCC awarded 29 June 1979, and continued Program Office contract engineering support.
2. (U) FY 1981 Program: The IP contractual effort will continue. Funding will be applied to that non-critical software effort remaining after DVP, and to hardware/software integration and testing. Program Office engineering support will continue.
3. (U) FY 1982 Planned Program: The Implementation Period contract effort will continue. Software efforts, integration and testing will receive priority attention leading to the Initial Operational Capability (IOC) of the first Region Operations Control Center (ROCC) in early 1982. Program Office engineering support will continue.
4. (U) FY 1983 Planned Program: Test and integration activities for the remaining US ROCCs will continue with emphasis placed on system testing. System deployment is scheduled to be completed in FY 1983.
5. (U) Program to Completion: No additional RDT&E funds are planned to be used on the JSS program.
6. (U) Milestones: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12411P
DOD Mission Area: Strategic Air Defense, #122

Title: Surveillance Radar Stations/Sites
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	9,052*	8,500	4,400	1,200	2,400	38,490
2433	SEEK IGLOO	9,052	8,500	4,400	1,200	2,400	38,490

*Reflects recent reprogramming action of minus \$718 thousand.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element supports the thirteen Alaskan Air Command air surveillance radar sites. The RDT&E project, SEEK IGLOO, will enhance the surveillance and air space control capability of Alaskan Air Command and reduce support costs. SEEK IGLOO will develop a minimally attended radar, using current technology to replace the existing separate surveillance and height finder radars. The new radar will have integral height finding capability and improved performance in the presence of clutter, and will be maintained by significantly fewer personnel than are required today.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to complete Development Test and Evaluation begun during FY 1981 and to conduct Initial Operational Test and Evaluation of a prototype radar at King Salmon Air Force Station, AK. The request also includes funds to implement production and continue program office support. Program cost estimates are based on negotiated contract prices and contractor performance data. Required program funds were reestimated in July 1980.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Procurement (Other)	10,100	8,500	4,500 54,700	700 67,400		37,000 122,100*

*Includes initial spares

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other) (Quantity, including prototype retrofit) Military Construction	46,777 (7) 42,500	47,294 (6) 45,564	4,371	98,442
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Project: #2433

Program Element: #12411F

DOD Mission Area: Strategic Air Defense, #122

Title: SEEK IGLOO

Title: Surveillance Radar Stations/Sites

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: Automation of the Alaskan Air Command and Control System is planned under the Joint Surveillance System program. In addition, the Air Force had previously planned a program to improve surveillance radar clutter rejection performance with a minor modification and an extensive military construction program to replace deficient support buildings at the radar sites. A study of alternative methods of radar improvement has shown that radar replacement with a new, minimally attended (no more than three radar technicians) radar and site equipment, using current technology, is the most cost effective means of providing the required capability. The new equipment will provide the required performance and significantly reduce maintenance costs. It will also greatly reduce the number of site personnel required thereby reducing the military construction program. The reduced military construction program and maintenance costs are expected to rapidly compensate for the investment in new equipment.

(U) RELATED ACTIVITIES: The study of alternatives and definition of technical requirements were performed under Program Element 12325F, Joint Surveillance System. The new radars are being designed to interface with the Joint Surveillance System equipment. The SEEK IGLOO minimally attended radars could also be used to enhance performance and logistics supportability of the Distant Early Warning Line, to replace Joint Surveillance System military radars to improve logistic supportability and to improve the current North American tactical warning and air defense system. One SEEK IGLOO radar will be diverted to satisfy an urgent requirement to replace an aged radar in Berlin, Germany. Reimbursement to replace the Alaskan asset will be provided by the Federal Republic of Germany.

(U) WORK PERFORMED BY: This effort is managed by the Electronics Systems Division, Hanscom AFB, MA; MITRE Corporation, Burlington, MA; Rome Air Development Center, Griffiss AFB, NY; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD, are supporting the effort. Design competition contracts were awarded to: General Electric Company, Syracuse, NY; ITT Gilfillan, Inc., Van Nuys, CA; and Westinghouse Electric Corp., Baltimore, MD. After evaluation of design proposals, a contract option to fabricate and test two preproduction prototypes was exercised in July 1979 with General Electric Co.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Program alternatives were studied and the minimally attended radar was selected for acquisition. A request for proposal for design, development and test was released and three six-month design competition contracts were awarded on 1 August 1978. The design competition was completed and General Electric Co. was selected in July 1979 to fabricate and test preproduction prototype radar equipment. Fabrication of subassemblies and radar groups began in early FY 1980. Development test and evaluation at the subassembly level began in September 1980.
2. (U) FY 1981 Program: Development Test and Evaluation will be conducted at the contractor's plant and at a government test range in Verona, NY. Planning for Alaskan Development Test and Evaluation and Initial Operational Test and Evaluation will be completed. Extensive reliability testing will begin in July 1981.

Project: #2433

Program Element: #12411F

DOD Mission Area: Strategic Air Defense, #122

Title: SEEK IGLOO

Title: Surveillance Radar Stations/Sites

Budget Activity: Strategic Programs, #3

3. (U) FY 1982 Planned Program: Alaskan Development Test and Evaluation and Initial Operational Test and Evaluation will be conducted at King Salmon Air Force Station, AK, and results will be evaluated prior to production of six radars planned to begin in May 1982. The preproduction equipment will be refurbished to the production configuration and remain onsite as the first operational radar. The military construction program to consolidate, replace, and upgrade essential site support facilities such as composite buildings and prime power generators will begin. Program restructuring by OSD reduced the FY 1982 procurement buy from eight to six with a corresponding reduction in funding.
4. (U) FY 1983 Planned Program: The first radar is planned to be operational in November 1982. Production of six minimally attended radars will be initiated. The RDT&E increase is based on a revised program estimate of required program office support and contractual effort. Overall, procurement funding decreased in FY 1983. An increase in procurement funding (\$13.1 million) resulting from a restructured buy of six radars (previously four) in FY 1983 was offset by a revised program estimate (decrease of \$16.6 million).

5. (U) Program to Completion: Radar production and installation is planned for completion by September 1984.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	9,052	8,500	4,400	1,200	2,400	38,490
Procurement (Other)			46,777	47,294	4,371	98,442

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	9,052	8,500	4,500		700	37,000
Procurement (Other)			54,700		67,400	122,100

The increase in total program RDT&E costs results from the need to continue program office support and fund Engineering Change Proposals through FY 1985. The decrease in total program procurement costs reflects revised program estimates based on negotiated contract costs.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 12417F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs To be determined
TOTAL FOR PROGRAM ELEMENT		0	0	21,700	15,200		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the development of an Over-the-Horizon Backscatter radar to improve our present limited capabilities for providing tactical early warning against attack on North America by bombers and air-to-surface missile carriers. Development of an Over-the-Horizon Backscatter radar to provide long-range surveillance down to the surface would: extend coverage of the coastal approaches from approximately 200 nautical miles to over 1800 nautical miles; increase warning time for survival of retaliatory forces; increase decision time for National Command Authorities; and significantly enhance redeployment options of available defense forces. In prior years, all OTH-B research and development was accomplished in Program Element 63703F. The sum of RDT&E funding from both 63703F and 12417F Program Elements is required for the planned acquisition of two 180 degree sites, one on each North American coast.

(U) BASIS FOR FY 1982 RDT&E REQUEST: FY 1982 funds will be used to initiate full scale engineering development of the 60 degree northeast operational Over-The-Horizon Backscatter radar site. The existing experimental radar system, located in Maine will be modified and augmented to bring it to operational status. The experimental radar system, which is presently undergoing a one year feasibility test, will be the hardware/software baseline for operational upgrading. Prior to the scheduled October 1981 Defense Systems Acquisition Review Council, plans based on feasibility demonstration results will be developed for operational upgrading. Transmitter and receiver hardware will be modified where necessary, equipment for two additional frequency bands will be developed and integrated for full use of the high frequency spectrum, operational software will be developed and tested with the new and modified hardware, and a supportable tactical operations center will be built for interface with the Canadian and Northeast Region Operations Control Center. In addition to providing the required engineering and test support, this program also continues the level-of-effort on Over-The-Horizon Backscatter technology and focuses technical efforts on northern surveillance alternatives. These efforts are designed to maintain acceptable program risk levels by increasing our knowledge of ionospheric limitations on performance supplementing the radar development in design areas promising high payoff, and insuring the availability of Over-The-Horizon scientific expertise.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not applicable

(U) OTHER APPROPRIATION FUNDS: Other appropriation funds are contained in Program Element 63703F.

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs To be determined
Military Construction	0	0	0	5,029		

Program Element: #12417F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Continental United States Over-the-Horizon Backscatter radar system will provide long range surveillance and tactical early warning to alert National Command Authorities to potentially hostile aircraft in the coastal approaches to North America. Present and planned coastal radars are line-of-sight limited and have significant low altitude surveillance gaps. These deficiencies cause warning time to be limited by the 200 nautical mile range and very low probability of detection for aircraft taking advantage of the gaps. Development of an all altitude, long range and wide area Over-The-Horizon Backscatter radar will complement Distant Early Warning radar coverage by preventing end-runs to the east and west coastal approaches; will increase warning time to permit survival of our retaliatory forces; will increase decision time for the National Command Authorities; and will significantly enhance redeployment options of defense forces. The initial phase, development and feasibility testing of an experimental Over-The-Horizon radar, was approved by the Defense System Acquisition Review Council and concurred with by the Worldwide Military Command and Control System Council in 1974. A contract for a prototype radar system was awarded in March of 1975. Due to projected cost and schedule problems, the program was restructured in FY 1976. The restructured program reduced prototype design capabilities and scope to an experimental radar system required to conduct a real time demonstration of technical feasibility. Operational configuration and "ilities" were deferred in implementing the design for the technical feasibility test.

(U) RELATED ACTIVITIES: The CONUS OTH-B radar system is being developed to provide all-altitude tactical early warning in support of our aerospace defense mission. Compatibility with related programs such as the Distant Early Warning Radars, the Joint Surveillance System, the E-3A Airborne Warning and Control System and air defense interceptors is planned. Related OTH system developments by the Office of Naval Research and the Naval Research Laboratory in the areas of ship detection and weather/sea state determination are monitored by the Air Force. A Memorandum of Agreement was signed by the Air Force and Navy in April of 1980 to establish a joint use equipment program for the Experimental Radar System. The Navy is using and will continue to use the Air Force Experimental Radar System for determination of simultaneous surveillance of aircraft and ships. Agreement with the Federal Aviation Agency and the Canadian Departments of National Defence and Transportation exists to provide North American air traffic in-flight data. Acquisition of the operational Over-The-Horizon radars is accomplished with Program Elements 63703F and 12417F (procurement).

(U) WORK PERFORMED BY: The development of the CONUS OTH-B radar system and supporting OTH technology efforts are managed by the Air Force Electronics System Division, Hanscom AFB, MA. The radar prime contractor is the General Electric Co., Syracuse, NY. Major subcontractors include Continental Electronics, Dallas, TX, for the transmitter subsystem and TRW, Redondo Beach, CA, for the software development. Subcontractors for the site preparation and construction efforts have been awarded to local Maine contractors in the Moscow/Caratunk area (transmitter site) and in the Washington County area (receiver site). Continuing OTH Technology efforts, analysis, engineering studies and support are provided by: Rome Air Development Center, Griffiss Air Force Base, NY; SRI International, Remote Measurements Laboratory, Menlo Park, CA; Defense Electromagnetic Compatibility Analysis Center, Annapolis, MD; Naval Research Laboratory, Washington, D.C.; MITRE Corporation, Burlington, MA; Air Force Aerospace Medical Division, Brooks Air Force Base, TX; Air Force Geophysical Laboratory, Hanscom Air Force Base, MA; and the Air Force Materials Laboratory, Wright-Patterson Air Force, OH.

Program Element: # 12417F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System
Budget Activity: Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The program was restructured in FY 1977 to reduce the prototype design implementation and test scope to an experimental radar required to demonstrate technical feasibility. Site preparation, erection of buildings and support services, and partial construction of the antennas were completed at both the transmitter and receiver sites in Maine. Configuration acceptance tests were completed on major hardware items, such as the transmitters, receivers, beamformer processor and the operator scopes. Software design was verified and coded. Technology efforts were initiated in the areas of low-sidelobe antenna developments, ionospheric modeling and prediction, adaptive beamforming, and radar performance assessment/management technologies. Development of the experimental radar system was continued in FY 1979. Fabrication/delivery of major hardware subsystems and the central processor software was completed. Installation of transmitter and receiver antennas was completed. Integration and equipment verification tests were accomplished for site controller software. In-plant testing of radar subsystems was accomplished and major on-site activity was completed. Fabrication, installation and integration of major components were completed. Site construction was finished and on-site system level integration and testing in preparation for the feasibility demonstration were completed. Acceptance testing was delayed for two months during the World Administrative Radio Conference. Technology efforts were continued to evaluate alternative display formats and signal processing/radar control algorithms. System level acceptance tests were accomplished during the second quarter of fiscal year 1980 and the radar system was delivered to the Air Force in May of 1980. The nine month system performance test was started on 1 June and continued through the remainder of the 1980 fiscal year.

2. (U) FY 1981 Program: Technical feasibility testing will continue through February 1981. Subsequent to this nine month test, a limited Initial Operational Test and Evaluation will be conducted for the next three months. All testing is scheduled for completion in June 1981 and the remaining four months of FY 1981 will be used to prepare all materials for the October 1981 Defense Acquisition Review Council. The Experimental Radar System will be used by the Navy during the last four months of FY 1981. The Navy is using this system to evaluate their operational utility of Over-the-Horizon Backscatter technology. Experimental Radar System technical feasibility will address the following: probability of detection, relative position accuracy, velocity resolution, track maintenance, ionosphere outages, radio frequency interference susceptibility and compatibility and real-time identification and correlation of targets. The limited Initial Operational Test and Evaluation will address electronic countermeasures and will provide for an independent assessment of technical feasibility. Continued technology studies are directed at system risk reduction supporting evaluation of radar design, ionospheric modeling and characterization, and propagation prediction.

3. (U) FY 1982 Planned Program: The October 1981 Defense Acquisition Review Council will make a deployment decision on East and West Coast operational radar systems. Preparation for a full-scale development program is underway. It is planned to upgrade the experimental radar system to a fully operational 60 degree segment. The Maine transmitter and receiver facilities will be expanded and modified where necessary and improved for operational use. A separate operations center will be developed and integrated into existing communications/warning networks. Frequency heads are to be added and operational software will be developed for the transmitter and receiver integration control and for radar data processing.

Program Element: # 12417F

DoD Mission Area: Strategic Air Defense, #122

Title: CONUS Over-the-Horizon Radar System

Budget Activity: Strategic Programs, #3

4. (U) FY 1983 Planned Program: Work will continue to upgrade the experimental radar system to a fully operational 60 degree segment. Testing of new and modified hardware and software will begin.

5. Program to Completion: All development and testing will be completed in fiscal year and the initial 60 degree sector will be declared operational in the Northeast. Additional 60 degree sectors will be replicated on each coast until the two 180 degree coastal over-the-horizon backscatter radar fans are complete

6. (U) Milestones:

A. (U) System Definition Complete	Date
B. (U) Prototype Contract Award	Nov 1973
C. (U) Initiate Program Restructuring	Mar 1975
D. (U) Conclude Technical Feasibility Test	Dec 1976
E. (U) Conclude IOT&E	Feb 1981
F. (U) DSARC Review and Deployment Decision	May 1981
G. Initial Operational Capability (NE 60° Sector)	Oct 1981
H. Initial Operational Capability (East & West 180°)	

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 12423F

Title Ballistic Missile Early Warning System
Budget Activity Strategic Programs, #3

DOD Mission Area: Strategic Surveillance and Warning, #132

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	9,100	13,000	6,300	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Ballistic Missile Early Warning System is being modernized to better support the national nuclear retaliatory strategy of flexible response. Planned improvements to radars and data processing equipment will increase the system's capability to detect, track and provide accurate and timely warning and assessment of the greatly increased threat posed by modern Soviet missiles equipped with Multiple Independently Targeted Reentry Vehicles. In addition, ongoing replacements of the site computers and control and display consoles will stop the deterioration in reliability caused by system aging and the nonavailability of spare parts.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Requested funds will allow the Air Force to complete the procurement of new Missile Impact Predictor computers for all three Ballistic Missile Early Warning Sites, with scheduled deliveries in April, June and October of 1982. It will allow us to initiate the procurement of an Ultra High Frequency upgrade to the Detection and Tracking Radars at the Thule, Greenland site with a planned contract solicitation in February 1981, contract award in September of 1981, and final delivery in late 1984. Cost estimates for the computer replacements are based on contract price while estimates for the radar modifications are based on an updated 1979 independent cost estimate.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
RDT&E	0	9,100	14,500	6,300	Continuing	Not Applicable
Procurement (Other)	0	44,000	21,400	Continuing	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement	1,537	44,996	12,954	0	Continuing	Not Applicable
Operation and Maintenance	3,884	7,234	2,925	1,770		

(593)

Program Element: #12423F

DOD Mission Area: Strategic Surveillance and Warning, #132

Title: Ballistic Missile Early Warning System
Budget Activity Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Ballistic Missile Early Warning System (BMEWS) was designed and built in the late 1950s and early 1960s. At the time, each having only one warhead; and our national nuclear retaliatory strategy was massive retaliation. Twenty years of system aging and a

The current system is capable of providing gross tactical warning with impact accuracies of about

Thus, it can provide adequate warning of an all out Soviet attack. It is also able, with the aid of site tracking radars, to track a small sampling of the raid to a greater accuracy of This information is used to provide a rudimentary characterization of the magnitude and objective of the enemy attack. However, in a less than all out attack, with limited objectives,

The proposed modifications to the detection and tracking radars at the Thule site would reduce the size of the range resolution cell by changing the radar bandwidth.

With this improvement in discrimination and an appropriate increase in the capacity of site computers, the sites will be able to track a much greater portion of the missile raid and provide considerably more accurate data for assessing the attack.

To do this will require additional modifications to the radars and appropriate upgrades to the other two sites.

(U) In addition to the Thule radar modifications, work will continue on the replacement of the Missile Impact Predictor computers and control and display consoles at all three sites to assure continued overall system reliability.

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Program Element: #12423F

DOD Mission Area: Strategic Surveillance and Warning, #132

Title: Ballistic Missile Early Warning System
Budget Activity Strategic Programs, #3

(U) RELATED ACTIVITIES:

The Ballistic Missile Early Warning System is part of the national system for Tactical Warning and Attack Assessment. and complements the information provided by the Sea Launched Ballistic Missile Detection and Warning and Aircraft Surveillance and Warning Systems. Ballistic Missile Early Warning Systems warning data is provided to the National Military Command Center, the Strategic Air Command Command Center and other users via the North American Air Defense Command (NORAD) 427M system and World Wide Military Command and Control System.

(U) WORK PERFORMED BY: Air Force Systems Command, Electronic Systems Division, Bedford, MA in conjunction with NORAD/Aerospace Defense Command, The Aerospace Defense Center, Strategic Air Command, and Air Force Communications Command. General system engineering is being provided by the Mitre Corporation of Bedford, MA. The Tactical Operations Room upgrade is under contract to RCA Government Systems Division, Moorestown, NJ. The Missile Impact Predictor computer replacement is under contract to Federal Electric Corporation of Paramus, NJ with major subcontracts to Control Data Corporation of Los Angeles, CA and Science Applications Incorporated of Huntsville, AL. Potential contractors interested in the radar modifications are Radio Corporation of America, Federal Electric Corporation, Raytheon, and General Electric Corporation.

Program Element: #12423F

DOD Mission Area: Strategic Surveillance and Warning, #132

Title: Ballistic Missile Early Warning System
Budget Activity Strategic Programs, #3

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Continued installation of Tactical Operations Room consoles and award of a contract to replace the Missile Impact Predictor computers at all three sites.
2. (U) FY 1981 Program: Complete installation of the Tactical Operations Room consoles, continue the Missile Impact Predictor computer replacement and award a contract for Ultra High Frequency upgrades to the Detection and Tracking radars at the Thule site.
3. (U) FY 1982 Planned Program: Complete the Missile Impact Predictor computer replacement at all three sites, continue the Thule radar upgrade. The decrease in RDT&E, Procurement and Operation and Maintenance funds in FY 1982 is due to the deletion of planned radar modifications to Ballistic Missile Early Warning System Site III (Fylingdales). Other small adjustments in FY 1980, 1981, and 1982 are due to readjustments of planned work efforts and escalation for inflation.
4. (U) FY 1983 Planned Program: Continue radar upgrades at the Thule site.
5. (U) Program to Completion: Completion of the Thule radar upgrades is scheduled for late 1984.
6. (U) Milestones: Not applicable.

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511 566

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12424F
DoD Mission Area: Space Defense, # 123

Title: SPACETRACK
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,200	6,700	8,200	5,800	Continuing	Not Applicable
2295	Ground-Based Electro-Optical Deep Space Surveillance System	2,800	1,200	2,400	1,400	Continuing	Not Applicable
0002	Ground-Based Sensors	3,400	5,500	5,800	4,400	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program incorporates near and far term operational systems into SPACETRACK in support of satellite attack warning and verification, rapid alerting for

efforts will (1) support the deployment of a five-site global Ground-Based Electro-Optical Deep Space Surveillance(GEODSS) system to beyond; (2)

Pacific radars: Defense Advanced Research Projects Agency Long-Range Tracking and Identification Radar (ALTAIR) on Kwajalein and GPS-10 radar (3) provide rapid and accurate calibration of all SPACETRACK radars using the Navy Transit satellites; (4) transition the Defense Advanced Research Projects Agency Maui Optical Site and HAYSTACK space object identification facilities to SPACETRACK for operational uses; (5) and provide extended range capability for selected SPACETRACK radars. Mission need is described in USAF Mission Element Need Statement for Space Defense (Antisatellite), 10 Dec 1980, and USAF Mission Element Need Statement for Space Defense (Surveillance), in Air Staff coordination.

These research and development out to synchronous altitude and

(U) BASIS FOR FY 1982 RDT&E REQUEST: The five-site GEODSS system started in FY 1977 will be continued. Research, development, test and evaluation funding for GEODSS is for software development, system/site engineering and testing, and support improvements, including charge-coupled device sensor replacement of GEODSS camera tubes. SPACETRACK modifications will be continued on existing sensors to more precisely and rapidly determine satellite orbits, to extend detection range of sensors using coherent data processing techniques, and to transition the HAYSTACK radar imaging capability to SPACETRACK for rapid tactical assessment of satellite missions. Design, system engineering, environmental surveys and software development will be continued for the ALTAIR modification and GPS-10 radar redeployment. Cost estimates are based on negotiated contracts and/or contractor inputs as modified by program office review and analysis.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,200	6,700	6,700		Continuing	Not Applicable
Procurement (Other)	1,201	6,154	9,700		Continuing	Not Applicable

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Program Element: #12424P

DoD Mission Area: Space Defense, # 123

Title: SPACETRACK

Budget Activity: Strategic Programs, # 3

(U) OTHER APPROPRIATION FUNDS:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
2295 Procurement (Other)* (Quantity)	1,201	1,200	17,800 (1)	3,000	Continuing	Not Applicable (5)
Military Construction	5,750	1,150			Continuing	Not Applicable
Operations and Maintenance	500	4,400	12,500	18,000	Continuing	Not Applicable
0002 Procurement (Other)* (Quantity)		5,400	3,100	1,000	Continuing	Not Applicable
Military Construction						
Operations and Maintenance	25,594	40,509	48,152	57,366	Continuing	Not Applicable

*Does not include initial spares. Procurement is for projects with research and development activity only.

(568)

Program Element: # 12424F

DoD Mission Area: Space Defense, # 123

Title: SPACETRACK

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: This program incorporates near-term operational improvements into SPACETRACK in support of satellite attack warning and verification, rapid alerting for _____ To support these requirements, four classes of improvements are required:

_____ This program will also support the far-term deployment of a space-based surveillance system being developed under Program Element 63428F, Space Surveillance Technology.

This program element funds activities that will correct the above deficiencies within the geographical limitation of ground-based systems. These activities will: (1) provide a five-site Global Ground-Based Electro-Optical Deep Space Surveillance capability that will detect and track all satellites from roughly 3,000 nautical miles to synchronous altitude, and beyond, and augment radar coverage at lower altitudes; (2) provide rapid and accurate calibration of all SPACETRACK radars using the Navy Transit satellites; (3) provide range extension to synchronous altitude for selected SPACETRACK radars; (4) transition the Defense Advanced Research Projects Agency Maui Optical Tracking and Identification Facility tactical mission assessment capability to SPACETRACK for operational use; (5) provide additional radar systems for

(U) RELATED ACTIVITIES: The baseline and technology for the Ground-based Electro-Optical Deep Space Surveillance (GEODSS) system and SPACETRACK calibration, extended range and radar imaging capabilities were developed and demonstrated under Program Element 63428F, Space Surveillance Technology. This program element is integrated with those programs that comprise the Space Defense System Program: Program Element 63438F, Satellite Systems Survivability; Program Element 12311F, North American Air Defense Combat Operations Center; Program Element 64406F, Space Defense System; Program Element 12450F, Space Defense Operations Center and Program Element 63428F, Space Surveillance Technology.

(U) WORK PERFORMED BY: Program management is provided by the Electronic Systems Division, Hanscom Air Force Base, MA, and Space Division, Los Angeles, CA. The GEODSS contractor is TRW, Newbury Park, CA. AVCO Everett Research Laboratories, Everett, MA supports the Maui Optical Tracking and Identification Facility. General systems engineering support is provided by MITRE Corporation, Bedford, MA and MIT/Lincoln Laboratories, Lexington, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The requirements for _____ were reviewed, resulting in the network design. Design and performance parameters were developed for the southwest Pacific radars. Operational testing and evaluation were conducted for ALTAIR on Kwajalein.

The GEODSS development and acquisition contract was awarded in FY 1978 and system critical design review was completed in FY 1979. During FY 1980 the GEODSS system in-plant development test and evaluation of software and hardware was conducted, and charge-coupled devices were examined for improving system performance and long-term supportability. Design changes were considered to modify the fourth and fifth GEODSS sites to a relocatable configuration to reduce the difficulty with foreign siting, and detailed design of the relocatable facilities was initiated.

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Program Element: # 12424F

DoD Mission Area: Space Defense, # 123

Title: SPACETRACK

Budget Activity: Strategic Programs, #3

An existing SPACETRACK radar at Clear, Alaska, was modified and tested in 1979 to operationally evaluate the improved accuracy through calibration using the Navy Transit satellites. This technique was developed under Program Element 63428F Space Surveillance Technology. Acquisition planning was completed for extended range modification of the radar at Diyarbakir, Turkey.

2. FY 1981 Planned Program: The first Ground-Based Electro-Optical Deep Space Surveillance (GEODSS) site will undergo initial operational test and evaluation in this period and reach an design of a relocatable facility will be completed and deployment of the remaining sites will continue. The ground-based sensors project will continue, including modification of HAYSTACK radar to improve its imaging capability and tactical responsiveness. Modifications/upgrades on the DARPA Long-Range Tracking and Identification Radar (ALTAIR) on Kwajalein will be completed. Calibration and range extension improvements at selected SPACETRACK radars will begin.

3. (U) FY 1982 Planned Program: The Ground-Based Electro-Optical Deep Space Surveillance system deployment will continue with the deployment of two sites. Development of charge-coupled devices and other upgrades will continue. The increase in procurement funds is required to purchase site 5 prime mission equipment. No funds are currently programmed for the site relocatable technical facility. The ground-based sensors project will continue with data processing, calibration and range extension modifications at selected SPACETRACK radars.

4. (U) FY 1983 Planned Program: The Ground-Based Electro-Optical Deep Space Surveillance system deployment will continue with delivery of one site. Charge-coupled device sensor upgrades will continue. Data processing, calibration and space object identification modifications will continue for selected SPACETRACK radars.

5. Program to Completion: Final operational capability of the GEODSS system is planned for [] contingent upon obtaining foreign site agreements and funding to complete fifth site procurement and deployment. Continuing improvements to the SPACETRACK system will be made to support space defense requirements for

Survivability of SPACETRACK ground-based sensors will be increased by improvements to communications, electronic warfare countermeasures and physical security. A requirement for surveillance of [] is being investigated and validation/procurement is anticipated. This program element will also support the far term deployment of a space-based space surveillance system in the late 1980's.

6. (U) Milestones: Not Applicable

(570)

Project: # 0002

Program Element: # 12424F

DoD Mission Area: Space Defense, #123

Title: Ground-Based Sensors

Title: SPACETRACK

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND: The current SPACETRACK network of sensors was evolved to support relatively benign requirements such as peacetime space object cataloging. Significant new demands are being placed on the SPACETRACK system to support new national space defense policies. Space surveillance for warning/verification/defensive countering of attacks against United States satellites, and targeting/strike assessment of attacks by United States antisatellite systems requires major improvements in timeliness, accuracy and quality of surveillance data collection and processing. This project develops, integrates and tests modifications to existing SPACETRACK radars to extend the range capability, improve the accuracy and enhance early orbit coverage of the SPACETRACK system. Specifically, this project will modify selected SPACETRACK radars to extend their range capability to synchronous altitude, provide rapid and accurate calibration (using Navy Transit satellites) and improve space object identification capability, including enhanced radar imaging. It will also incorporate the Defense Advanced Research Projects Agency Long-Range Tracking and Identification Radar (ALTAIR) on Kwajalein and GPS-10 radar in the

(U) RELATED ACTIVITIES: The technologies for the SPACETRACK ground-based sensors upgrades were developed and demonstrated under Program Element 63428F, Space Surveillance Technology. This project is closely integrated with all the programs which comprise the Space Defense Systems Program. The current breakout clearly separates upgrades to ground-based elements of SPACETRACK from the Ground-Based Electro-Optical Deep Space Surveillance (GEODSS) system which is also being procured and deployed under this program element.

(U) WORK PERFORMED BY: Program management and systems engineering are provided by the Electronic Systems Division, Hanscom Air Force Base, MA, and Space Division, Los Angeles, CA. General systems engineering and development of SPACETRACK upgrade techniques is being performed by MITRE Corporation, Bedford, MA, and MIT/Lincoln Lab, Lexington, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The requirements for SPACETRACK range extension, calibration/accuracy improvement, early orbit coverage and space object identification upgrades were defined. A network design was established and technologies to support the upgrades were demonstrated (under Program Element 63428F, Space Surveillance Technology). The Defense Advanced Research Projects Agency Maui Optical Tracking and Identification Facility was transitioned to operational SPACETRACK use in FY 1979. Modification (hardware and software) of the ALTAIR on Kwajalein to improve both its high altitude (detection and tracking) and low altitude (imaging) performance continued. Engineering details for other SPACETRACK sensor upgrades (improved orbit determination and space object identification) were defined.

2. FY 1981 Planned Program: Modification to existing SPACETRACK radars (for range extension, coherent data processing and calibration) will be initiated. The modified ALTAIR will achieve an _____ as part of the SPACETRACK system and modifications to the Lincoln Lab HAYSTACK radar will continue for transition to operational use.

Project: # 0002

Program Element: # 12424F

DoD Mission Area: Space Defense, #123

Title: Ground-Based Sensors

Title: SPACETRACK

Budget Activity: Strategic Programs, #3

3. (U) FY 1982 Planned Program: The calibration and range extension modifications of selected SPACETRACK radars will continue. Data processing improvements for improved orbital determination and space object identification will be made to support satellite attack warning/strike assessment. The decrease in procurement funds in this project is required to fund the GEODSS site 5 prime mission equipment in project 2295.

4. (U) FY 1983 Planned Program: Modifications to improve performance of SPACETRACK ground-based sensors will continue with implementation of advanced space object identification techniques.

5. (U) Program to Completion: Continuing modifications to the SPACETRACK system will be required as other space defense system elements (antisatellite operations, defensive countermeasures and attack warning/verification) evolve and mature. Evolutionary, incremental enhancements to USAF SPACETRACK capabilities will be implemented to support space defense monitor/inform, protect and negate missions.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RD&E	3,400	5,500	5,800	4,400	Continuing	Not Applicable
Procurement (Other)		5,400	3,100	1,000	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Descriptive Summary:

RD&E	3,400	5,500	4,500		Continuing	Not Applicable
Procurement (Other)		4,954	8,200		Continuing	Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12431P

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	31,000	87,570	146,300	TBD	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Support Program is the key element of the Worldwide Military Command and Control System Network. It is a space-based surveillance system that

satellites in geostationary orbit, two large processing stations, one simplified processing station, and a ground communications network. The Defense Support Program provides

The system consists of

BASIS FOR FY 1982 RDT&E REQUEST: Funds are included for the design and development of satellite 14 and beyond with survivability upgrades. The design and development will be completed in FY 1983. Production of satellites 14 - 17 will start in FY 1982 for those components which are not new and do not require major redesign. Continuation of modifications for compatibility with Shuttle/Titan III(34)D/Inertial Upper Stage is included. Two satellites scheduled for a FY 1981 delivery will be Titan III(34)D/Inertial Upper Stage compatible and two satellites scheduled for a FY 1982 delivery will be Shuttle/Inertial Upper Stage compatible. Mobile Ground Terminal (MGT) and the associated user interface design will be completed in FY 1982. The Mobile Ground Terminals are scheduled for an Initial Operational Capability Funds are also included for General Systems Engineering/Integration. Cost data were derived by the Air Force Systems Command's Program Office, using a combination of contractor estimates and past experience.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	31,000	72,900	135,300	153,100	Continuing	Not Applicable
Procurement (Missile)	103,862	51,931	192,280	173,200	Continuing	Not Applicable
Procurement (Other)	26,574	90,132	10,733	75,100	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (Missile) (Quantity)	103,862 (1 retrofit)	52,008	230,254 (Start 4) (Continue 4)	200,260 (Continue 4)	Continuing	Not Applicable
Procurement (Other)(Includes initial spares) (Quantity)	26,574	70,305 (2 MGTs)	101,806 (3 MGTs)	9,357	Continuing	Not Applicable
Operations and Maintenance	33,505	50,835	53,434	63,118	Continuing	Not Applicable

Program Element: #12431F

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program
Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION:

The Defense Support Program (DSP) was developed as an outgrowth of the and other related developments. DSP satellites contain infrared sensors, The system is operational and provides near real-time

to the National Command Authorities (NCA) and other designated users. The system also provides these more specific data:
the satellite program and provides data on

In addition, DSP is replacing

The system's current deployment consists of

Two dedicated ground stations, one overseas and one within the Continental United States (CONUS), receive, process, and transmit The Simplified Processing Station provides a backup capability to the current ground stations to enhance mission data survivability and increase the probability that data will be available. It is currently deployed in the CONUS, but can be moved overseas in about a two week period. The Joint Chiefs of Staff have designated the Aerospace Defense Command, Strategic Air Command, National Military Command System, Atlantic Command, Pacific Command, European Command,

as users of DSP data. Evolutionary satellite improvements are intended to prolong the useful life of each satellite, make the satellite more survivable in environments, increase the viewing area of each satellite, and increase the accuracy of data provided on to more precisely define the for the NCA decision-making process. Modifications under development will ensure that the DSP payloads are compatible with Shuttle/Titan III(34)D/Inertial Upper Stage (IUS) capabilities. The Mobile Ground Terminals will provide DSP data survivability by developing a truck mounted data processing and communication capability

Future satellites scheduled for delivery starting in FY 1985 will include significant data survivability improvements.

RELATED ACTIVITIES: Program

were predecessor programs. Program

were prior program designs.

developing the technology for a possible successor program

Appropriate procurement phasing with the follow-on DSP program is being addressed in program planning. Defense Satellite Communications System (P.E. 33110F) provides primary communications routing for DSP overseas data and will help provide Mobile Ground Terminal communications. Space Boosters (P.E. 35119F) provides launch support. Space Vehicle Subsystems Advanced Development (P.E. 63401F) is developing technology for improved satellite stabilization techniques. The National Emergency Airborne Command Post (P.E. 32015F) and Post-Attack Command and Control System (P.E. 11312F) are potential users of DSP data. DSP is the key element of the Worldwide Military Command and Control Systems (WWMCCS) Network and is related to the other elements of the network (WWMCCS Architecture P.E. 63735F). After transition to the Space Shuttle, Space Launch Support Program (P.E. 35171F) will provide IUSs and Space Shuttle flights for DSP missions. DSP Communications (P.E. 12447F) provides operations and maintenance for the DSP Ground Communication Network.

Program Element: #12431F

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

WORK PERFORMED BY: Commander-in-Chief, Aerospace Defense Command, maintains operational control of Defense Support Program (DSP) for the Joint Chiefs of Staff. Strategic Air Command and the Air Force Communications Command are the system operators and maintainers of the DSP ground stations. Air Force Systems Command's Space Division, Los Angeles, CA, has overall development and procurement management responsibility and program management of the satellites. The Air Force Logistics Command provides engineering and logistics support. Air Force Weapons Laboratory, Kirtland Air Force Base, NM, will provide facility support. The Air Force Test and Evaluation Center, Kirtland Air Force Base, NM, participates in test and evaluation of selected system segments. TRW, Redondo Beach, CA, is the prime contractor for the spacecraft and satellite integration. Aerojet Electro Systems Company, Azusa, CA, is the prime contractor for the infrared sensor and the computer replacement. The Martin-Marietta Aerospace Company, Denver, CO, builds the Titan III boosters. The Department of Energy (Sandia Corporation) has responsibility for the IBM, Thousand Oaks, CA, is the prime contractor for all software efforts as well as the prime contractor on the Simplified Processing Station and Mobile Ground Terminals. Technology Development Corporation of Santa Clara, CA, is the prime contractor for the Ground Communications Network. The Aerospace Corporation, Inglewood, CA, furnishes general systems engineering/integration for the DSP System Program Office.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Significant accomplishments to date include procurement of 13 satellites and 12 Titan IIIC boosters, construction of two data processing facilities, and provision of user displays, software, communications and a training facility (also used for software development and mission data analysis), completion of Research and Development (R&D) for modifications to satellites 10-12 to improve survivability in a hostile environment and to provide data survivability, completion of R&D for an improved focal plane for satellite 13 and completion of development of hardware and software for the Simplified Processing Station. Development, initiated in FY 1976, continues on an improved sensor to provide increased viewing area and more accurate

In June 1976, a software package was delivered which enables the system

modifications for satellite retrofit to improve survivability in a hostile environment was initiated. R&D support for

DSP augmentation was completed. Ground station modifications for compatibility with a satellite anti-jam command capability were completed. Satellite Tracking Set Training Equipment was delivered.

Program Element: #12431P

DoD Mission Area: Strategic Surveillance

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

Upper Stage (IUS) compatibility continues. In December 1978 the Simplified Processing Station (SPS) was shipped to for Initial Operational Test and Evaluation. The testing was completed in June 1979. A satellite calibration experiment was performed to determine

Ground Communications Network started in August 1979 to provide data to an Airborne Command Post. In June 1980 a contract was awarded to replace the computers in the Defense Support Program (DSP) ground stations and the training and development facilities. This replacement is necessary to provide processing capability for new satellites and to avoid obsolescence.

2. FY 1981 Planned Program: A Milestone I Defense Systems Acquisition Review Council (DSARC) for the Warning System was held in December 1979. The purpose of this DSARC was to review alternatives for increasing

The two primary alternatives were:

(1) to start the advance development of the

or (2) to improve the survivability of the current DSP. In February 1980 the Deputy Secretary of Defense chose the option that increased the survivability of the current DSP, primarily because of the greater technological risk of

These survivability upgrades include the following: (1) Mobile Ground Terminal will provide survivability to the ground processing of satellite data

Design of the Mobile Ground Terminals and the associated user interfaces will start in FY 1981. The basic computers and software will be the same as those used in the Simplified Processing Station. The design funds will be used primarily for the repackaging of the components, the new antenna subsystem, and to ensure that the mobility requirements are met. A total of six Mobile Ground Terminals are required to ensure survivability of DSP data with today's threat. The System Operational Concept calls for

Two MGTs are planned for procurement in FY 1981. Also the design and development of the survivability upgrades, which will be incorporated on satellite 14 and beyond, will start in FY 1981. Survivable DSP data will support our

Expenditures include the continuation of the DSP satellite compatibility development with the Shuttle/Titan III(34)D/IUS. This development is necessary to ensure that the DSP satellites are compatible with the IUS interfaces and support the program transition to a Shuttle launch capability. The development efforts will be applied to insure that the system design will incorporate launch and recovery loads, safety requirements, interface compatibility and contamination protection. The current plan for DSP satellite launches is as follows: one more Titan IIIC launch, two Titan III(34)D/IUS launches, and all subsequent launches on Shuttle/IUS. Orbital operations data analysis, survivability and satellite improvement efforts will continue.

Program Element: #12431F

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

3. (U) FY 1982 Planned Program: A major part of the FY 1982 funds will be applied to the design and development of the satellite 14 and beyond survivability upgrades. The components for satellite 14 fall in one of the following three categories: (1) those that are the same as on previous satellites; (2) those that require various levels of redesign due to obsolescence, shuttle compatibility, etc.; and (3) those that require design and development (primarily the survivability upgrades). In order to meet the projected need date and to make the survivability upgrades available as soon as possible, the production program is planned to start in FY 1982 before the components in category (3) above have completed design and development. This approach is considered low risk because the category (1) and (2) components form the basic satellite. The FY 1982 planned production program includes a block buy of satellites 14-17 starting in FY 1982 with incremental funding through FY 1986. This programming approach will save over \$130 million for the four satellite procurement over the business as usual method which would require the full funding procurement of one satellite each in FY 1982, FY 1983, FY 1984, and FY 1986. The development of the payload/Titan III(34)D/Shuttle/Inertial Upper Stage compatibility will continue. The Mobile Ground Terminal and associated user interface design will be completed. Three production Mobile Ground Terminals are planned for procurement. General system engineering/integration will be continued. Orbital operations data analysis, survivability, computer software improvements, and satellite improvement efforts will continue. The changes from the FY 1981 submission reflect: more accurate cost data for the survivability upgrades for RDT&E and procurement (missile); and the Mobile Ground Terminal and computer replacement reschedule in procurement (other).

4. (U) FY 1983 Planned Program: The satellite survivability upgrade design and development will be completed. The development of the payload/Titan III(34)D/Shuttle/Inertial Upper Stage compatibility will continue. General system engineering/integration will continue, as well as orbital operations data analysis, survivability, computer software improvements and satellite improvement efforts.

5. (U) Program to Completion: This is a continuing program. RDT&E funding will support continuing satellite/system development in support of Department of Defense requirements. Primary emphasis will be directed toward eliminating or minimizing operational employment deficiencies, the use of the Space Shuttle and/or Titan III(34)D/IUS in lieu of the Titan IIIC, the development of a survivable DSP system through Mobile Ground Terminals and satellite upgrades, and the adequacy of the ground station data processing capability.

6. Milestones:

A.
B.
C.

D. Delivery of Satellite #5

E.

F. Delivery of Satellite #6

G. Delivery of Dual Satellite Software

Date

Mar 1973

Jul 1973

Feb 1974

Program Element: #12431F

DOD Mission Area: Strategic Surveillance

Title: Defense Support Program

Budget Activity: Strategic Programs, #3

H.	Delivery of Satellite #8	May 1974
I.	Delivery of Satellite #7	Oct 1974
J.	Delivery of Satellite #9	Mar 1975
K.	Software Logic complete	Jun 1976
L.		
M.		
N.	Delivery of Simplified Processing Station (SPS)	Dec 1978
O.		
P.		
Q.	Deliver Simplified Processing Station Link Status Capability	1Q CY 1981
R.	Retrofit of Titan III(34)D/Inertial Upper Stage (IUS) Compatible Satellite Complete	4Q CY 1981
S.	Retrofit of Shuttle/IUS Compatible Satellite Complete	3Q CY 1982
T.	Completion of Ground Communications Network Upgrade	1Q CY 1983
U.	Completion of Computer Replacement	2Q CY 1983
V.		
W.	Satellite #14 Delivery	4Q CY 1985
X.	Satellite Launches	As required

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

Test and Evaluation Data

1. Development Test and Evaluation: The Defense Support Program has been designed, developed, tested and deployed as an operational system in the early 1970's. The system is a classified space program consisting of ground control and readout stations that receive data from satellites, process the data, and present information to the National Command Authorities and military commanders for decision-making purposes. Development, Test and Evaluation/Initial Operational Test and Evaluation on the prototype Simplified Processing Station was completed in 1978. Over the next several years three major system upgrades will require Development Test, and Evaluation. They are the Sensor Evolutionary Development and Advanced Atmospheric Burst Locator upgrades; the Mobile Ground Terminals; and the Satellite 14 and beyond survivability upgrades. The Sensor Evolutionary Development satellites will have an increased number of
The major system improvements resulting from this increase is as follows:

These upgrades have three different elements: the satellite, the software modifications and the ground station upgrade which involves replacing the computers. The sensor portion of the satellite is being produced by Aerojet ElectroSystems Corporation and the spacecraft is being produced and integrated by TRW, Incorporated. Development, Test and Evaluation will be performed at the Aerojet ElectroSystems Corporation and TRW facilities prior to government acceptance, which is scheduled for fiscal year 1982. The satellites will then be stored until there is a launch requirement. The computers are being replaced at all Defense Support Program locations by Aerojet ElectroSystems Corporation. This replacement is scheduled to be completed by fiscal year 1983. Development, Test and Evaluation will be accomplished on this replacement in conjunction with acceptance testing. The system software is being modified to accommodate the Sensor Evolutionary Development satellites by International Business Machines Corporation. Development, Test and Evaluation will be accomplished prior to turnover to Strategic Air Command (scheduled for fiscal year 1982) who will integrate the software into the operational system. This initial software installation will process data from the current satellite configuration. When the first Sensor Evolutionary Development satellite is launched, Air Force Systems Command will accomplish a system level Development, Test and Evaluation to insure that all elements of the system work together, including the satellite, the ground station hardware and the software. The purpose of the Mobile Ground Terminals is to provide survivability to the Defense Support Program ground processing and communication elements through mobility. They will use the same computer hardware and software as the Simplified Processing Station. The prime contractor will be International Business Machines Corporation. Development, Test and Evaluation will be accomplished on the antenna which is new and at the Mobile Ground Terminal system level to ensure that the Mobile Ground Terminal can meet its mobility and communication goals. Satellite 14 and beyond will include several survivability upgrades directed by a Defense System Acquisition Review Council.

579

579

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

Development of these satellites will start in late fiscal year 1981 and the first will be delivered in late fiscal year 1985. The ground station and software modifications have not been defined. The Development, Test and Evaluation program for these upgrades will be very similar to the Sensor Evolutionary Development Development, Test and Evaluation program.

2. Operational Test and Evaluation: Combined Development, Test and Evaluation and Initial Operational Test and Evaluation was performed on the Defense Support Program prototype Simplified Processing Station from 26 August 1978 to 6 November 1978 at Vandenberg Air Force Base, California. This combined test was then followed by dedicated Initial Operational Test and Evaluation from _____ Space Division was responsible for Development, Test and Evaluation while the Air Force Test and Evaluation Center, assisted by personnel from the Aerospace Defense Command (Operating command for Defense Support Program), managed and conducted Initial Operational Test and Evaluation. Initial Operational Test and Evaluation was conducted using simulated and "real world" missile launch events with prototype Simplified Processing Station hardware and software. The objectives were to evaluate the system's performance and to estimate the reliability, availability and maintainability of an operationally deployed system. The Initial Operational Test and Evaluation report, October 1979, identified three major deficiencies which would prevent the Simplified Processing Station from being operationally useful. These were: _____

_____ and excessive computer-generated message error rate - mission messages were periodically rejected at the data distribution center because of parity error. As a result, mission messages were lost. Additionally, the Initial Operational Test and Evaluation operational availability was _____

Phase I follow-on operational test and evaluation of the Simplified Processing Station was conducted by Air Force Test and Evaluation Center at the _____

from 7 January 1980 through 5 February 1980. The purpose of the Phase I follow-on operational test and evaluation was to confirm correction of the deficiencies identified during Initial Operational Test and Evaluation; however, the Simplified Processing Station continued to exhibit _____

_____ Strategic Air Command will conduct a 30-day Phase II follow-on operational test and evaluation in January 1981 to confirm the effectiveness of this procedure and to support the declaration of an initial operational capability. Operational Test and Evaluation for the Sensor Evolutionary Development satellites and Advanced Atmospheric Burst Locator, Mobile Ground Terminals and satellite 14 and beyond is currently being defined.

580

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

3. System Characteristics:

Characteristics

For the current operational system

Objectives

Demonstrated

Simulation
Live events
Simulation
Simulation
Simulation

Operational
Simulation
Simulation
Limited live eve

Improvement for Sensor Evolutionary Development and Advanced Atmospheric Burst Locator

For the Simplified Processing Station

Development Test & Evalu-
ation, about for simu-
lated scenario during Ini-
tial Operational Test &
Evaluation
Development, Test & Evalu-
ation, Deficient during
Initial Operational Test &
Evaluation
Development, Test & Evalu-
ation, Initial Operational
Test & Evaluation

Budget Activity: Strategic Programs, #3
Program Element: #12431F, Defense Support Program

Characteristics

Objectives

Demonstrated

Development, Test & Evaluation, Initial Operational Test & Evaluation
percent during Initial Operational Test & Evaluation
- per week during Initial Operational Test & Evaluation

Development, Test & Evaluation, Initial Operational Test & Evaluation
Development, Test & Evaluation only

(U) Satellite 14 and Beyond Improvements

582

582

527

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12433F

Title: Integrated Operational NUDETS Detection
System (IONDS)

DOD Mission Area: Strategic Surveillance and Warning, #132

Budget Activity: Strategic Programs, #3

(U) The efforts for this Program Element(PE) are described within PE 31357F, page 1043.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #12450F

DoD Mission Area: Space Defense, #123

Title: Space Defense Operations (Antisatellite)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		0	14,465	1,100	2,100	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is the companion program to the antisatellite (ASAT) development effort funded under Program Element (PE) 64406F, Space Defense Systems (Antisatellite) and provides for the operational deployment of the production ASAT capability. This requires the production of ASAT interceptors, modification of aircraft and the procurement of special handling and test equipment. In addition, RDT&E funding is required for development of training aids and manuals, transition of test software to operational formats and support of Initial Operational Test and Evaluation efforts.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Operational unique studies and trade-offs will continue and Prototype Miniature Air-Launched System operational deficiencies will be investigated and solutions developed. Cost estimates are based on System Program Office analyses and contractor cost proposals.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E**	0	14,508	26,142	-	91,200	131,800

(U) OTHER APPROPRIATION FUNDS:

-Aircraft Modification	0	0	0	4,800	Continuing	Not Applicable
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** (U) In the FY 1982-1983 time frame, the majority of RDT&E funding reflected in the FY 1981 Descriptive Summary was transferred to PE 64406F, Space Defense Systems (Antisatellite) to more accurately reflect how the Air Force is using this funding to develop the baseline United States antisatellite capability.

(28)

Program Element: #12450F

DoD Mission Area: Space Defense, #123

Title: Space Defense Operations

Budget Area: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: Baseline planning for the Initial Air Force nonnuclear antisatellite (ASAT) capability envisions deployment of modified F-15 air-defense interceptors at bases. These F-15's will serve jointly as air-defense interceptors and ASAT carrier aircraft. Preliminary planning calls for procurement of Prototype Miniature Air-Launched Systems (PMALS) ASAT missiles to support operational deployment. Prior to Initial Operational Capability (IOC), special support and test equipment unique to the ASAT mission must be designed and developed. Training programs and technical publications to prepare the operating command to assume responsibility for the weapon system will be developed. A combined development test and evaluation and Initial Operational Test and Evaluation (IOT&E) effort is planned and will require engineering and technical support from the development agency and contractors. As development test results are available, minor changes in ASAT design may be required. RDT&E funding in this Program Element (PE) will support design modifications of the ASAT to an operational configuration. Finally, ASAT computer software modifications dictated by flight-test results will be funded within this PE.

(U) RELATED ACTIVITIES: This program supports Space Defense Systems, PE 64406F, and other program elements in the Space Defense Systems Program: PE 63428F, Space Surveillance Technology; PE 63438F, Satellite Survivability; PE 12424F, SPACETRACK; PE 12311F; North American Air Defense Command Combat Operations Center.

(U) WORK PERFORMED BY: This program is managed by Air Force Systems Command Space Division, Los Angeles, CA. Primary contractors are Vought Corporation, Grand Prairie, TX and Boeing Aerospace Corporation, Seattle, WA. Aerospace Corporation, El Segundo, CA provides technical support. Aircraft and modifications will be contracted to McDonnell Douglas Aircraft Corporation, St. Louis, MO.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable
2. (U) FY 1981 Program: Operational unique studies and trade-offs will be conducted for the PMALS mission. Operational-related deficiencies in the design will be corrected.
3. (U) FY 1982 Planned Program: PMALS operational deficiencies will continue to be investigated and trade-offs developed for corrections.
4. (S) FY 1983 Planned Program: PMALS operational deficiencies discovered during pre-flight testing will be investigated and trade-offs developed for corrections.
5. (U) Program to Completion: RDT&E support will continue as required through 1988.
6. Milestones: Initial Operational Capability (IOC): (See PE 64406F for additional Milestones).

Title: Minimum Essential Emergency Communications Network (MEECN)
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING): (\$ IN THOUSANDS)

<u>Project Number</u>	<u>Title</u>	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	Total for Program Element	8,350	14,352	45,600	TBD	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program supporting the Chairman, Joint Chiefs of Staff, who is responsible for.

the Survivable Low Frequency Communications System to increase range and jam resistance. Current emphasis is on projects to improve

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds to complete the development of an improved receive antenna for EC-135 and E-4 Airborne Command Posts and a higher power transmitter for the EC-135 aircraft. Two programs to improve system performance, to be started in late FY 1981, will be continued in FY 1982. These are a more reliable trailing-wire transmit antenna, and an automatic message processing capability for reduction of errors in received messages to extend the range of acceptable system performance. Development of an adaptive high-frequency system will be continued, and a new program to develop a very-low-frequency receiver system for bomber aircraft will be initiated. A program will also be initiated to acquire a network of low-frequency relay stations to support communications between the National Command Authorities and forces based in the continental United States. Funding requested is based in part upon forecasts to complete development already under contract, in part upon engineering estimates, and in part upon parametric studies by cost analysts assigned to the Air Force Systems Command.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated Costs</u>
RDTE						
Procurement (Other)	8,500	13,500	26,900	Not Applicable	Continuing	Not Applicable
Procurement (Aircraft)	12,550	-	3,929	Not Applicable	Continuing	Not Applicable
	Funding in related program elements for aircraft modifications to implement the systems being developed in Program Element 33131F was not included in the FY 1981 Descriptive Summary.					

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)	14,095	TBD	Continuing	Not Applicable
Procurement (Aircraft)				
PE 11142F	8,100	11,900	Continuing	Not Applicable
PE 11312F	2,980		Continuing	Not Applicable

Program Element: # 33131F

DoD Mission Area: Strategic Communications, #133

Title: Minimum Essential Emergency Communications Network (MEECN)

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Minimum Essential Emergency Communications Network consists of systems

and low-frequency regions of the spectrum have attributes useful in strategic communications. These include low ambient propagation loss, significant penetration of seawater, and relatively good performance in a nuclear disturbed environment. Primary current emphasis in this program element is on improvements to our existing very-low-frequency/low-frequency communications system to extend range, improve jam-resistance, and increase accuracy of messages received at all ranges. The system consists of (1) airborne transmitters and receivers in EC-135 and E-4 airborne command post aircraft; (2) transmitters and receivers at fixed ground locations at Silver Creek, Nebraska, and Hawes, California; and (3) receivers at Strategic Air Command wing command posts, intercontinental ballistic missile launch control centers, and northern area radio relay sites. The improvements are based upon validated requirements of the Strategic Air Command and the other Single Integrated Operational Plan Commanders-in-Chief, system deficiencies as reported by the Defense Communications Agency, and priorities of the Joint Chiefs of Staff.

(U) RELATED ACTIVITIES: This program is coordinated with work by the Defense Communications Agency, Navy, and Army in complementary portions of the Minimum Essential Emergency Communications Network Program Element 33131. Modification funding for installing the system improvements is contained in PE 11142F, KC-135 Squadrons, and in PE 11312F, Post Attack Command and Control System. Special demodulators to provide jamming resistance were procured with FY 1979 and FY 1980 funds, and these demodulators will be installed in TITAN II and Minuteman launch control centers using funds programmed in PE 11212F, TITAN Squadrons, and PE 11213F, Minuteman Squadrons.

(U) WORK PERFORMED BY: Electronic Systems Division located at Hanscom AFB, Massachusetts, has managerial responsibility for the Research, Development, Test, and Evaluation with support from the Air Force Logistics Command and Strategic Air Command. Supporting contractors are Westinghouse Electronic Corporation, Defense and Electric Systems Center, Baltimore, Maryland (jam-resistant modulators/demodulators and higher power airborne transmitter for EC-135s); Spears Associates, Norwood, Massachusetts (horizontally polarized antenna); and Analytical Systems Engineering Corporation, Burlington, Massachusetts (system engineering support).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Development of jam-resistant modulators and demodulators was completed in August, 1978 and a production contract was awarded to Westinghouse in November, 1978. Subsequently, the Silver Creek, Nebraska and Hawes, California, fixed transmitter sites were modified as well as the E-4B National Emergency Airborne Command Post and an EC-135 airborne command post assigned to the Commander-in-Chief, Atlantic forces. A 200-kilowatt amplifier was also installed in the E-4B aircraft by the Boeing Company, Seattle, Washington. Two feasibility models of 100-kilowatt transmitters were fabricated and tested at ground installations, with the development of modification kits to install 100-kilowatt transmitters on the EC-135 aircraft as the ultimate objective. A contract was awarded to Westinghouse Electric Corporation in October, 1979 for full scale development of these high-power transmitters. This development will improve connectivity with ground, sea, and airborne elements of the Air Force, Navy, and Army supporting the Minimum Essential Emergency Communications Network. The Preliminary Design Review and the Critical Design Review were completed in 1980. In another area, airborne tests of propagation of the horizontally-polarized component of very-low-frequency/low-frequency signals were conducted in 1976-1978 and revealed that significant jam-resistance and range improvements

Program Element #33131F

DoD Mission Area: Strategic Communications, #133

Title: Minimum Essential Emergency Communications Network (MEECN)
Budget Activity: Strategic Programs, #3

are possible by (a) using antennas oriented to receive the horizontally-polarized signal components, (b) automatically combining the horizontally-polarized signals with the currently-received vertically-polarized signals, and (c) producing composite messages automatically by combining the result of the two polarized inputs with repeated transmission of the same message. A contract was awarded in July, 1980, for full-scale development of the horizontally-polarized antenna, and plans were made during 1980 for full-scale development of Diversity Reception Equipment to do the automatic combining and signal processing of the two polarized signals and the message repetitions described above. Support was also provided to the Defense Communications Agency in preparation for demonstration of an adaptive high-frequency communications concept planned for FY 1981 and FY 1982.

2. (U) FY 1981 Program: During FY 1981, on-going full-scale development programs will be continued; activities will include the Preliminary Design Review and the Critical Design Review for the horizontally-polarized antenna and the start of flight testing of the 100-kilowatt transmitter. A preliminary contract will be awarded to a disadvantaged, small business contractor for structuring the Diversity Reception Equipment development program. The full-scale development will be conducted through the Small Business Administration, with contract award expected late in the year. Support is also being continued on the adaptive high-frequency concept demonstration. Programs will also be initiated to develop an improved, more durable, trailing-wire transmit antenna for the EC-135 aircraft and to plan for development of an adaptive high-frequency communications system.

3. FY 1982 Planned Program: Funds are requested to complete the development of two of the improvement programs discussed above. These are the horizontally polarized antenna and the 100-kilowatt higher-power transmitter for the EC-135 airborne command posts. Initial Operational Test and Evaluation will be conducted for both of these systems and production will be initiated. In addition, the full-scale development of the Diversity Reception Equipment will continue to build up momentum during FY 1982, with the Preliminary Design Review planned for early in the fourth quarter. Production will begin on the 100-kilowatt transmitter in mid-year. The concept demonstration of adaptive high-frequency in support of the Defense Communications Agency will be concluded. Two new programs will be initiated this year. The first is the development of very-low-frequency receivers for bomber aircraft to permit direct reception of emergency action messages being transmitted in this frequency regime. The second new program is to initiate acquisition of a system of approximately 500 low-frequency relay stations to provide a

Finally, development will be continued on the improved trailing-wire antenna for the EC-135 airborne command posts and on a new generation of high-frequency radio equipment which will adapt automatically to unknown or changing propagation conditions.

4. (U) FY 1983 Planned Program: The primary effort planned for FY 1983 is the continuation of full-scale development of the Diversity Reception Equipment under the auspices of the Small Business Administration. The Critical Design Review will be held in preparation for assembly of development models.

5. (U) Program to Completion: This is a continuing program which must assure successful communications to strategic forces as the threat to such communications evolves. Future projects include development of interference cancellation techniques to increase the quality of signals received.

6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33601F

Title: Air Force Satellite Communications (AFSATCOM) System

DoD Mission Area: Strategic Communications, #133

Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	Total for Program Element	17,650	31,355	50,100	TBD	Continuing	Not Applicable
2478	Air Force Satellite Communications	17,650	31,355	50,100	TBD	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program consolidates the development, procurement and installation of the ground, aircraft and satellite communications equipments needed to satisfy critical needs of the National Command Authorities and the military Commanders-in-Chief for reliable, worldwide communications for command and control of the Single Integrated Operational Plan and other designated forces.

(U) BASIS FOR FY 1982 RESEARCH DEVELOPMENT TEST AND EVALUATION REQUEST: Includes funds for development of consolidated ground terminal remoting and message routing subsystems; hardware and software maintenance tools; operational monitoring aids; a single channel transponder and associated Emergency Action Message transmit and receive subsystems; full scale development of the upgrade to Launch Control Center terminals for improved performance in a nuclear environment; improvements to provide improved jam resistance and to service more users with limited channels; improvements to airborne command post connectivity to nuclear weapon storage sites; and to evaluate airborne relays for contingency restoral of UHF satellite communications. The cost estimates for these efforts were obtained by using in-house cost estimating relationships and contractor estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
Research Development Test and Evaluation	19,200	61,400	63,400	-	Continuing	Not Applicable
Procurement (Missile)	200	13,464	0	-	Continuing	Not Applicable
Procurement (Other)	35,647	27,288	14,140	-	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (Missile)	0	6,248	0	TBD	Continuing	Not Applicable
Quantities (Single Channel Transponders)	-	1	0	3		
Procurement (Other)*(includes initial spares)	35,429	24,175	14,543	TBD	Continuing	Not Applicable
Quantities (Ground Terminals)	114	51	8	10		

Project Number: #2487

Program Element: #33601F

Title: Air Force Satellite Communications

Title: Air Force Satellite Communications System

DoD Mission Area: Strategic Communications, #133 Budget Activity: Strategic Programs, #3

(U) WORK PERFORMED BY: The Air Force Satellite Communications System is managed by the Space Division, Los Angeles Air Force Station, CA. Support facilities include the Camp Parks, CA, Satellite Test Facility and aircraft assigned to Strategic Air Command and to Air Force Systems Command. The transponders on the Satellite Data System are built by Hughes Aircraft Company, EL Segundo, CA, and on the Fleet Satellite Communications System by TRW INC, Redondo Beach, CA. The terminal development/production is managed by the Electronics Systems Division, Hanscom AFB, MA. Terminal development was conducted by the Collins Telecommunications Products Division of Rockwell International, Cedar Rapids, IA. Terminal production is managed by the Collins Communications Systems Division of Rockwell International, Newport Beach, CA. System modems are produced by LINKABIT Corp, La Jolla, CA. The transponders that will be deployed on the Defense Satellite Communications System spacecraft were developed by General Electric, Valley Forge, PA. Federal Contract Research Center support is provided by the Aerospace Corporation, Los Angeles, CA, MITRE Corporation, Bedford, MA and Lincoln Laboratory, Lexington, MA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Initial Operational Test and Evaluation was completed in October 1975 using a host transponder in polar orbit and pre-production terminals. A terminal production decision was received on 30 June 1976 and delivery of airborne and command post terminals began in July 1978.

Fleet Satellite Communications System satellites were launched successfully in February 1978, May 1979, January and October 1980. Interfaces between this System and other command and control systems were developed to assure interconnectivity, and the consolidated ground terminal effort was initiated to reduce the number of major ground terminals required for the system. Over 200 terminals have been installed in B-52, FB-111, EC/RC-135, and E-4B aircraft and selected ground command posts. Initial Operational Capability was achieved in May 1979. In April 1979, the Deputy Secretary of Defense approved the Defense System Acquisition Review Council decision to proceed with the concept validation and demonstration phase of the Strategic Satellite System's new satellite and associated terminals and to continue development of the single channel transponders and their associated terminal improvements. Funding for that program was included in the FY 1979, 1980 and 1981 budget requests; however, Congress did not approve the funding requested for the initial development of the new replacement satellites and associated improved terminals. As a result, an evaluation of system alternatives capable of providing the required communications services is now in progress.

2. (U) FY 1981 PROGRAM: FY 81 funding reflects Congressional deletion of funds for a dedicated strategic satellite system. Continuing efforts include the multi-year ground terminal consolidation and remoting projects, development of an encryption capability with the National Security Agency, the multi-year development of the Defense Satellite Communications System Phase III single channel transponder and its message injection subsystem, and concluding the development of the Global Positioning System Phase III single channel transponder. The single channel transponder on the Defense Satellite Communications System spacecraft increases the survivability, both electromagnetic and physical, of Emergency Action Message dissemination. Electromagnetic survivability is provided by higher frequency uplinks and physical survivability by proliferating targets. The production of launch center terminals will continue. The installation of terminals in B-52, EC-135 and FB-111 aircraft and ground command centers will continue. The uplink transmission subsystem to the Defense Satellite Communications System transponder will be completed and tested with the in-orbit

Project Number: #2487

Program Element: #33601F

DoD Mission Area: Strategic Communications, #133

Title: Air Force Satellite Communications

Title: Air Force Satellite Communications System

Budget Activity: Strategic Programs, #3

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force Satellite Communications System program is an ultra high frequency communications system that provides command and control communications to the National Command Authorities, the Joint Chiefs of Staff, the military Commanders-in-Chief, the nuclear and supportive forces and selected high priority users. The wartime mission of this System is (1) to disseminate Emergency Action Messages, (2) to provide conferencing communications to Commanders-in-Chief from their worldwide locations, (3) to direct the forces, (4) report status and (5) terminate hostilities. In peacetime this system is used during training exercises, contingency operations, crisis management, search and rescue, humanitarian missions, and for relay of reconnaissance information and missile testing data. Terminals will be installed in B-52's and FB-111's, in Minuteman and Titan launch control centers and in airborne and ground command posts, tankers, reconnaissance and surveillance aircraft, and ground based cruise missile launch centers. The space segment consists of multi-channel transponders on the Satellite Data System, Fleet Satellite Communications System and classified host spacecraft. Single channel transponders are being developed for improved assurance of transmitting the Emergency Action Messages to the forces and will be deployed on several host spacecraft including the Defense Satellite Communication System and the Satellite Data System satellites. To achieve the survivable two way, worldwide communications needed to provide command and control communications through crisis management and all phases of nuclear war, improvements to the Air Force Satellite Communications System are needed. These required improvements are higher availability of service, increased capacity to serve the growing terminal population, and improved electromagnetic and physical survivability. Many alternatives were considered including upgrading the multi-channel transponders on the Satellite Data System, deploying only single channel transponders, acquiring new satellites with substantially upgraded communications, or using adaptive high frequency radio and Meteor Burst Communications. The alternative selected at the Defense System Acquisition Review Council in January 1979 consisted of new satellites at 110,000 miles, single channel transponder on selected host spacecraft, and integration of higher frequencies, more robust modulation, higher power signal amplification and communications security into existing terminals. These improvements for electromagnetic and physical survivability were designed specifically to meet the threat projected for the 1985-2000 period. Initial developmental funding for these new satellites and associated terminal improvements was not approved by Congress in FY 1979, 1980 and 1981. As a result, that approach and alternatives are being reevaluated at this time with the objective of identifying the preferred approach for an FY 1983 start. These alternatives address tactical and intelligence community requirements as well as strategic communications requirements.

(U) RELATED ACTIVITIES: Aircraft terminals are funded in the weapons system program. Approved Air Force users include the following program elements: 11113F, B-52; 11142F, EC- and RC-135; 11115F, FB-111; 11312F, E-4; 27222F, KC-10A; 11212F, Titan; and 11213F, Minuteman Launch Control Centers. The Minuteman, 11213F, and Titan, 11212F, Intercontinental Ballistic Missile programs will integrate the satellite terminals into the launch control facilities. Additional users include the Navy TACAMO Program and Army Nuclear Weapons Storage Sites. Program Element 63431F, Advanced Space Communications, provides centralized planning for improved satellite communications and develops and demonstrates technology to increase the reliability and survivability of space communications. That technology is transferred to this Program for operational development. Program Element 33110F, Defense Satellite Communications System, funds host spacecraft and will fund and procure the single channel transponders in FY 1982. The Satellite Data System, Program Element 35158F, and Program Element 33109N, Navy Satellite Communications, are the major satellite systems hosting Air Force Satellite Communications System equipment.

Project Number: #2487

Program Element: #33601F

DoD Mission Area: Strategic Communications, #133

Title: Air Force Satellite Communications

Title: Air Force Satellite Communications System

Budget Activity: Strategic Programs, #3

transponder. Components to permit the terminals to use the improved modulation and faster frequency hopping will be developed. Full scale development of capabilities to transmit Emergency Action Messages with improved jam-resistance from command posts, to improve connectivity from airborne command posts to the nuclear weapons storage sites and to improve message reception at the missile launch control facilities are planned. Planning, analysis of alternatives and preparation for a major Department of Defense review of alternative approaches to satisfying the command and control communications requirements of the National Command Authorities, the Joint Chiefs, the Single Integrated Operational Plan Commanders and the selected high priority users will occur.

3. (U) FY 1982 PLANNED PROGRAM: The ground terminal consolidation program will be completed. Development of capabilities to improve the jam-resistance of the system and to improve connectivity from airborne command posts to the nuclear weapons storage sites in Europe and development of the improved receive capability for launch control centers will continue. Concept definition and initial design of an airborne relay system for contingency restoral of UHF satellite communications will begin. The FB-111, B-52G and EC/RC-135 terminal installations and the major portion of the B-52H, command post and Intercontinental Ballistic Missile launch control center terminal installations will be completed. The results of the Follow on Operational Test and Evaluation effort will be documented, and essential system changes will be made. The difference between the FY 1982 request (\$50.1M) and the FY 1982 estimate (\$63.4M) contained in the FY 1981 Descriptive Summary is due to the deletion of funding for the Strategic Satellite System's new satellite and terminals and revised estimates of inflation.

4. (U) FY 1983 PLANNED PROGRAM: The Air Force Satellite Communications System ground terminal program will be completed. The development of the more jam-resistant airborne subsystem and improvement to the European airborne command posts will continue. Installation of ultra high frequency terminals in E-4B's and KC-10's will continue. Completion of development and initial testing and procurement of the upgrades to the terminals at the missile launch control centers are planned. Installation of terminals in B-52H's will be completed. The Air Force Satellite Communications System is planned to evolve into an electromagnetically and physically survivable command and control capability. Development of the new space capability and terminals with superior jam resistance is planned to begin.

5. (U) PROGRAM TO COMPLETION: This is a continuing program to provide highly jam resistant and survivable command and control communications for the nuclear capable forces and other high priority users.

Project Number: #2478
 Program Element: #33601P
 DoD Mission Area: Strategic Communications, #133

Title: Air Force Satellite Communications
 Title: Air Force Satellite Communications System (AFSATCOM)
 Budget Activity: Strategic Programs, #3

Milestones:		DATE
6.		
A.	Development Start	Jan 1973
B.	Test and Evaluation Complete	Oct 1975
C.	Terminal Production Decision	Jul 1976
D.	Terminal Production Start	Dec 1976
E.	First Terminal Delivery	Jul 1978
I.	Fleet Satellite Communications System (F-1) Launch	Feb 1978
K.	Lincoln Experimental Satellites (demonstrated advanced technology)	Mar 1976
L.	Mission Element Need Statement	Oct 1978
M.	First Strategic Satellite System Defense System Acquisition Review Council I	Jan 1979
O.	Fleet Satellite Communications System (F-2) Launch	May 1979
P.	Initial Operational Capability Milestone	May 1979
Q.	Fleet Satellite Communications System (F-3) Launch	Jan 1980
R.	Fleet Satellite Communications System (F-4) Launch	Oct 1980
T.	Second Defense Acquisition Review Council I	Nov 1981
U.	Begin Initial Development for replacement satellites and improved terminals	Mar 1981 Jan 1983
V.	Full Operational Capability for Air Force Satellite Communications System	Dec 1983

EXPLANATION OF MILESTONE CHANGES

* Congress denied FY 1981 funds for the Concept Validation Phase.

Budget Activity: Strategic Programs, #2

Program Element: 33601F - Air Force Satellite Communications System

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Air Force Satellite Communications System Terminals were developed by Collins Radio Company, Cedar Rapids, Iowa. The terminals are designed on the modular concept, with capabilities ranging from single channel to simultaneous multi-channel, multiple satellite communications. Increases in capability are achieved by exchanging or adding modules. Development testing was conducted in-plant and as part of initial operational testing. This testing demonstrated that the technical performance of the system supported its intended use and confirmed expected theoretical performance. Transponders providing a single communications channel will be deployed on the Defense Satellite Communications System Phase III spacecraft as a modular and evolutionary approach to improving the Air Force Satellite Communications system. This single channel transponder and the associated ground transmission equipments were tested in each contractor's plant and together. These tests demonstrated the technical compatibility of the ground and space segments.

2. (U) Operational Test and Evaluation: The Initial Operational Test and Evaluation was combined with the Development Test and Evaluation. The Air Force Test and Evaluation Center conducted the initial operational testing which began on 1 February 1975 and was concluded on 30 September 1975. Development testing was extended to verify design fixes for identified equipment deficiencies.

(U) The testing objectives were accomplished in six categories or phases of tests, which included: (1) demonstrations of basic system/terminal functional capabilities; (2) performance tests; (3) network tests; (4) B-52, EC-135 network demonstrations; 5) logistic supportability tests, and (6) RC-135 special operability/compatibility tests. The first test category demonstrated basic operational capabilities and limitations of the system, terminals, and terminal subsystems. The second and third test categories together provided an estimate of effectiveness and suitability of an actual network in an operational environment. The fourth test category served to verify that the results of the first three categories were applicable to two specific operational installations. The fifth test category evaluated logistics supportability under conditions approximating those anticipated when the system becomes operational. The final test category evaluated special RC-135 limited test objectives. The initial period of the combined test program emphasized technical testing. As the test program progressed, the emphasis shifted from technical to operational testing. Technical and operational tests were performed concurrently when such testing could be conducted on a noninterference basis. Airborne technical performance testing provided operational performance data which could be correlated with network test data. The operational testing involved seven test sites (no ranges), six test aircraft, nine preproduction terminals, one satellite, and a satellite simulator. Airborne terminals were installed on operational and test aircraft. All four ground terminals were used in an operational configuration. Air Force personnel, trained formally or on-the-job, operated the terminals to provide realistic operator/terminal interface evaluations. The number of operators per terminal during any one test was the same as that expected during operational conditions for that terminal configuration. Formally trained operators were supplied by the Strategic Air Command, Military Airlift Command, Air Force Communications Command, Electronic Security Command and the 6th and 9th Airborne Command and Control Squadrons. Contractor personnel were present to perform maintenance.

Budget Activity: Strategic Programs, #2

Program Element: 33601F - Air Force Satellite Communications System

(U) The sixty-seven deficiencies identified during initial operational test and evaluation were prioritized by the using commands and provided to the System Program Office for resolution. Sixty-six of these have been corrected and officially closed. The remaining deficiency is an electromagnetic compatibility problem between the system terminals and other systems already on board the B-52 and KC-135 aircraft. This will be corrected by fixes incorporated into production hardware on the aircraft. The fixes for all operational deficiencies will be evaluated during the next phases of operational testing.

(U) The final Air Force Satellite Communications initial operational test and evaluation report was published in December 1975.

(U) On 1 July 1976, the Secretary of the Air Force/Installations and Logistics made a decision to proceed with production provided that fixes for the deficiencies were included in the production contract which was subsequently awarded to Rockwell International.

(U) Follow-on operational test and evaluation on the production terminals started in January 1980. Air Force Test and Evaluation Center will conduct phases I and II and monitor phases III and IV. Test phases I and II involve verification of fixes for deficiencies and wideband network performance. Strategic Air Command will conduct phases III and IV, which will evaluate operational effectiveness and suitability as the network complexity increases due to more terminals being fielded. According to the current schedule, phases I and II will end in September 1981 and phases III and IV in September 1982. All users will participate in the testing. The terminals will be operated and maintained by the appropriate using agency personnel. This follow-on testing will be accomplished using the Satellite Data System and Fleet Satellite Communications System operational satellites; production terminal equipments installed in B-52's, FB-11's and KC-135's and operational procedures developed by the using commands. The objectives are to evaluate performance in an operational environment and to verify reliability, maintainability and fixes to deficiencies. Operational assets performing normal training missions will be used to the extent practical.

(U) The Air Force Test and Evaluation Center team will conduct a two month initial operational test of the single channel transponder on the first Defense Satellite Communications System Phase III preproduction satellite. The ground terminal equipments will be engineering development models to be located at Offutt Air Force Base, NE, and Sunnyvale, CA and connected by telephone lines. This segment of testing will begin in September 1981 if the satellite is launched successfully by July 1981.

Budget Activity: Strategic Programs, #2

Program Element: 33601F - Air Force Satellite Communications System

3. System Characteristics:

<u>Characteristics</u>	<u>Objectives</u>	<u>Demonstrated</u>	<u>Demonstrated By</u>
Data rate (Words/Minute)	100	100	Operational Test
Error Rate			Operational Test
Anti-Jam Protection (decibel/watt)			
Air Force Satellite Communi- cations System			Development Test
Single Channel Transponder			
Ultra High Frequency			Development Test
Super High Frequency			Development Test
Mean time between failure	100 to 1,000 hours depending on terminal configuration	To Be Determined To Be Determined Yes	Development Test Development Test Development Test

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35158F

DoD Mission Area: Strategic Communications, #133

Title: Satellite Data System
Budget Activity: Strategic Programs, #3

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980			FY 1981		FY 1982		FY 1983		Additional to Completion	Total Estimated Costs
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate				
N/A	TOTAL FOR PROGRAM ELEMENT	36,400	43,200	29,100	15,600	Continuing	Not Applicable					

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Satellite Data System is a multi-payload, communications satellite which provides reliable communications portion of the coverage required by the Air Force Satellite Communications System for essential command and control communications to our nuclear capable forces. It also provides a high speed link between Air Force Satellite Control Facility remote tracking stations for command and control of national space assets

The Satellite Data System provides a

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for continuing the multi-year design and development efforts to improve the anti-jam capabilities of the Air Force Satellite Communications System payload. Also included is the multi-year development necessary to produce a Space Shuttle optimized satellite. The Critical Design Review for these efforts occurs in this fiscal year. Sustaining engineering support, required on a continuing basis, is also included. These estimates are based on contractor proposals and past experience for the sustaining engineering support.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980			FY 1981		FY 1982		FY 1983		Additional to Completion	Total Estimated Costs
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate				
Procurement (MISSILE)	36,300	45,300	27,900	Continuing	Not Applicable						
	100,200	92,700	39,400	Continuing	Not Applicable						

(U) OTHER APPROPRIATION FUNDS:

Procurement (MISSILE) (Quantity)	100,200 (1)	95,500 (1)	43,200	161,900 (1)	Continuing	Not Applicable
Operation and Maintenance	8,500	10,300	11,300	11,500	Continuing	Not Applicable

597

597

Program Element: #35158F

DoD Mission Area: Strategic Communications, #133

Title: Satellite Data System

Budget Activity: Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The Satellite Data System provides critical, real-time command, control, and communications for Strategic Air Command Single Integrated Operational Plan and other nuclear capable forces. It is an integral part of the Air Force Satellite Communications System which also includes the Ultra High Frequency communications capability on the geosynchronous Fleet Satellite Communications satellites, piggy-back transponders on selected host satellites, and airborne/ground radio terminals. As such, the Satellite Data System complements the Fleet Satellite Communications coverage by providing the polar coverage which the other satellites cannot provide. The Satellite Data System began an operational addition, the Satellite Data System supports the Air Force Satellite Control Facility requirement for reliable, two-way high data rate communications with its remote tracking stations.

The direct benefits of the Satellite Data System are reliable and secure direct communications which will result in greatly improved command and control of our nuclear capable forces, elimination of the dependence on some of the vulnerable Air Force Satellite Control Facility communications and

RELATED ACTIVITIES: The space segment of the Fleet Satellite Communications System was developed, procured, and launched under the Navy's Program Element, 33109N. The Air Force ground Ultra High Frequency radio terminals needed for operation with the Fleet Satellite Communications and Satellite Data System satellites are funded within the Air Force Satellite Communications System Program Element, 33601F. Terminals installed in aircraft were funded in the specific weapons system/aircraft Program Element. The Air Force Satellite Control Facility network is funded under Program Element, 35110F. flights for the Satellite Data System satellites are provided by the Space Launch Support Program, Program Element, 35171F.

(U) WORK PERFORMED BY: Air Force Systems Command's Space Division, Los Angeles, CA, is responsible for the Satellite Data System. The prime contractor is Hughes Aircraft Company, El Segundo, CA. General Systems Engineering and Integration is performed by the Aerospace Corporation, El Segundo, CA.

Program Element: #35158F

DoD Mission Area: Strategic Communications, #133

Title: Satellite Data System
Budget Activity: Strategic Programs, #3

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The technology phase of the program was completed in FY 1971. This was followed by a contract definition phase in FY 1972 which established the system configuration. The system acquisition contractor was selected by competitive source selection and a system development contract was awarded in June 1972. The system Critical Design Review was successfully completed in March 1974 with all critical specifications being met or exceeded. The structural model satellite testing was finished in May 1975. A qualification model satellite was built and tested to fully qualify the satellite prior to production. The first satellite was launched on the second satellite on All payloads were fully checked out on-orbit. Full operational capability was declared for all payloads in after successful on-orbit checkout.

Primary activities in FY 1980 included the continuation of design and development activities associated with improving the anti-jam capabilities of the Air Force Satellite Communications System payload on the sixth and subsequent satellites, the continuation of the multi-year development of a Space Shuttle optimized design on the sixth and subsequent satellites, reliability improvement efforts, and sustaining engineering support.

(U) 2. FY 1981 Program: Efforts for this year include sustaining engineering support, continuing design and development activities to improve the anti-jam capabilities of the Air Force Satellite Communications System payload on the sixth Satellite Data System satellite, and continuing the multi-year development necessary to transition the sixth and subsequent satellites to the Space Shuttle. FY 1981 is the peak year for these development efforts, culminating in a Critical Design Review and qualification testing. Also included are continuing efforts to improve satellite payload reliabilities.

(U) 3. FY 1982 Planned Program: Planned efforts include the continuation of the development efforts related to the Space Shuttle optimization and the completion of the development of the Air Force Satellite Communications payload anti-jam improvements. Sustaining engineering support and payload reliability improvements will also be continued. The difference in the current and previous year estimates is price escalation based on an increased inflation factor.

(U) 4. FY 1983 Planned Program: The FY 1983 plan is to continue sustaining engineering support and payload reliability improvements and to complete the development efforts related to Space Shuttle optimization.

Program Element: #35158F

DOD Mission Area: Strategic Communications, #133

Title: Satellite Data System

Budget Activity: Strategic Programs, #3

5. Program to Completion: This is a continuing program. As an integral part of the Air Force Satellite Communications System, the program will continue to provide critical communications coverage and be totally compatible with the system's aircraft and ground radio terminals. Sustaining engineering support will be required to maintain design compatibility and to incorporate improvements for survivability and reliability. Replenishment satellites will be procured to provide the required operational availability for the

6. Milestones:

Program Start
System Preliminary Design Review
System Critical Design Review
Launch First Satellite (F-1)
Launch Second Satellite (F-2)
Full Operational Capability
Launch Third Satellite (F-3)*

Date

October 1971
March 1973
March 1974

AFSATCOM System IOC

May 1979

Critical Design Review for Shuttle
Optimized (Seventh) Satellite

June 1981

* Date presented in Fiscal Year 1981 Descriptive Summaries

EXPLANATION OF MILESTONE CHANGES:

Budget Activity: Strategic Programs, #3

Program Element: #35158F, Satellite Data System

1. Development Test and Evaluation: The development contractor for the Satellite Data System was Hughes Aircraft Company, El Segundo, California. The first satellite was launched in Initial Operational Capability was established in The first satellite (F-1) was funded entirely within the development program. The second satellite (F-2) was the first vehicle funded under the production program. The development hardware included engineering models of the communication subsystems, a structural model spacecraft (X-1) and a qualification model spacecraft (Y-1). Development tests of the communications subsystems engineering models were completed in November 1973. Structural testing was satisfactorily completed on the X-1 engineering model spacecraft in May 1975. Systems level qualification was completed in October 1975 with all critical performance specifications met or exceeded. System level qualification was designed to demonstrate design integrity and performance to specification via a series of tests including shock, acoustic, modal survey, thermal, electromagnetic interference, solar-thermal vacuum, and integrated system test. The F-1 spacecraft was acceptance tested during the The Y-1 spacecraft was a fully configured spacecraft which has been refurbished and designated as flight vehicle (F-4).

2. (U) Operational Test and Evaluation: A portion of the Satellite Data System is to be part of the Air Force Satellite Communications space segment. Classical separate Initial Operational Test and Evaluation was not conducted on the space segments since all operational objectives and requirements were fully integrated into the Development Test and Evaluation effort and were not broken out separately. Compatibility, operational characteristics, and orbit performance of payloads supporting the Air Force Satellite Communications program are scheduled to be demonstrated during the follow-on test and evaluation which is managed by the Air Force Test and Evaluation Center. Results to date are contained in Development Test and Evaluation reports (see paragraph 1 above).

3. Systems Characteristics:

Characteristics

Objectives

Demonstrated

Data Rate in words
per minute

Message Bit Error Rate
per ten thousand bits

Anti-Jam Protection (decibel watt)

601-602B

545

601-602B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63228F

Title: Next Generation Trainer

DOD Mission Area: Air Warfare Support, #225

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion To Be Determined	Total Estimated Costs To Be Determined
	TOTAL FOR PROGRAM ELEMENT	1,900	-0-	14,700	39,400		

(Individual Project Listing)

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A need exists to maintain the Air Force's capability to provide primary flight training in its Undergraduate Pilot Training program. The Next Generation Trainer program is a development effort to modernize or replace the T-37 aircraft to ensure that this capability exists beyond 1986. Forecast increases in USAF pilot training requirements in the mid-1980s, and the fact that the aging T-37 will begin to reach fleet insufficiency around 1986, dictate an Initial Operational Capability for the Next Generation Trainer in 1987. The essential design characteristics include twin engines, side-by-side seating, and pressurization with significant improvements in performance (range, climb capability, sustained "g"), maintainability, and noise pollution.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The funded Concept Exploration Studies by five contractors were complete on 16 October 1980, and confirm that the Next Generation Trainer program is low technical and schedule risk and is relatively low cost. The fiscal year 1981 funding of \$2.0 million dollars was deleted by the Congressional Appropriations Conference Committee. Existing funds will be used to continue the fiscal year 1981 activity. The T-34C evaluation and source selection activity for the Next Generation Trainer proposals will be accomplished in fiscal year 1981. In the Spring 1982, a prime contractor will be selected and the development of the engine and airframe will commence. The fiscal year 1982 funding request for 14.7 million dollars is based on development estimates by Air Force Systems Command during preparation of the fiscal year 1982 Program Objective Memorandum.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion To Be Determined	Total Estimated Costs To Be Determined
RDT&E Procurement (not identified)	1,900	2,000	14,400	37,700		

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 63228F

DOD Mission Area: Air Warfare Support, #225

Title: Next Generation Trainer Aircraft
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The T-37 aircraft is a twin-jet, side-by-side seating trainer aircraft. It replaced the T-34 aircraft and has been used with great success in the primary phase of Air Force Undergraduate Pilot Training for over 20 years. The Next Generation Trainer program is an acquisition effort to replace the T-37 with a new aircraft, an off-the-shelf jet trainer, or a modernized T-37 to remedy the following deficiencies:

(U) (a) The aircraft, of early 1950's design and technology, is approaching the end of its 15,000 hour certified life. With forecast increases in pilot production in the mid-1980's, the aging T-37 fleet will become numerically insufficient to sustain the required pilot production beyond late 1986. The current acquisition plan will provide an Initial Operational Capability (54 aircraft) by the first quarter of fiscal year 1987.

(U) (b) The fuel consumption of the T-37 turbo-jet engines, relative to current turbo-fan engines, results in high operational costs and an unnecessary drain on our limited fuel supplies. These costs are exacerbated with the spiraling increase in fuel prices. The Next Generation Trainer will reduce fuel consumption in primary flight training by approximately 50%.

(U) (c) The hydraulic, electrical, and fuel systems are becoming less reliable resulting in high ownership costs. The maintenance manhours per flying hour on a more modern Next Generation Trainer will be approximately 60% of those required on a T-37.

(U) (d) The engine noise levels of the T-37 significantly exceed those permissible under the Federal Aviation Regulation Part 36.

(U) (e) The limited range and endurance restrict training during periods of marginal weather.

(U) (f) The limited performance and lack of pressurization restrict the training envelope to altitudes below 25,000 feet above mean sea level. The airspace at lower altitudes is becoming increasingly congested, more hazardous, and more difficult to dedicate to military training.

(U) (g) The limited weather capability of the T-37 unnecessarily hampers training missions and reduces training potential.

(U) (h) Outdated instrument displays are not consistent with those of modern Air Force operational aircraft.

(U) Acquisition of a new or modernized primary training aircraft will allow the exploitation of technology advancements in aircraft design, engine performance, and avionics design. These factors result in a lower weight, easier to maintain, improved performance, and a more fuel efficient aircraft with a significant life cycle cost savings. A more important factor is that the Next Generation Trainer will permit the Air Force to have a sustained pilot production capability beyond 1986.

Program Element: # 63228F

DOD Mission Area: Air Warfare Support, #225

Title: Next Generation Trainer Aircraft
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The US Navy plans to replace the T-2C and TA-4J aircraft with a new jet training system, the VTXS. The trainer aircraft will be designated the VTX and will be used in their advanced or second phase of training. The Air Force Next Generation Trainer, however will be used in the initial or primary phase of Air Force training. The VTX is too complex to be used as a primary trainer. The Air Force and Navy have held a number of informal working meetings to discuss the acquisition planning for each services trainer development programs.

(U) WORK PERFORMED BY: The Air Force management of the Next Generation Trainer is accomplished by the Next Generation Trainer System Program Office at the Air Force Systems Command Aeronautical Systems Division, Wright Patterson Air Force Base, Ohio. The five contractors who participated in the Concept Evaluation Studies were: CESSNA, FAIRCHILD, GENERAL DYNAMICS, ROCKWELL, and Vought. These five contractors will comprise the source list from which a Request For Proposal for Full Scale Development will be solicited.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The System Program Office was established at Wright Patterson Air Force Base following the approval of the Mission Element Need Statement in July 1979. In June 1980, funded Concept Exploration Studies were awarded to five contractors. These studies were complete in October 1980, and confirm that the Next Generation Trainer Program is low risk technically, has a schedule which is realistic, and is relatively low cost.

2. (U) FY 1981 Program: Existing funds will be used to continue the Next Generation Trainer acquisition activity. The Concept Exploration Phase Study results will be used to refine the requirements and schedules to be incorporated in the Request For Proposal, to be released in September 1981. The Navy T-34C aircraft will be evaluated to assess its suitability to accomplish the primary phase of Undergraduate Pilot Training. This evaluation will occur during the summer and early fall of 1981.

3. (U) FY 1982 Planned Program: A contractor will be selected and development and test activity on the airframe and engine will be initiated. The funding request for fiscal year 1982 increased to 14.7 million dollars from 14.4 million dollars due to adjustments to accommodate inflation. Procurement funds will be identified beginning in fiscal year 1983 using data from the concept studies as the basis of the funds required. Simulator funding, to be identified beginning in fiscal year 1983, will be used in modifying the existing T-37 Instrument Flight Simulator. The simulator modification is essential to conducting the planned primary phase of training without increases in both the number of aircraft and flying hours currently planned for the primary phase.

4. (U) FY 1983 Planned Program: The development and test activity for the airframe and engine will continue and production funding will begin. Planning for T-37 simulator modifications to the Next Generation Trainer configuration will continue.

Program Element: # 63228F

DOD Mission Area: Air Warfare Support, #225

Title: Next Generation Trainer Aircraft
Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: Actual flight test activity will begin around February 1984. This testing will determine airframe/engine compatibility, allow for handling qualities to be assessed, verify airplane performance, and provide time to refine the subsystems and avionics interface with the aircraft. A production decision is expected in the Spring of 1985 with the first production aircraft delivered in the Fall of 1986. The production rate of the contractor selected will determine the completion date for the Next Generation Trainer program. The total Research Development Test and Evaluation costs and production costs are not yet determined.

6. (U) Milestones:

A. Mission Element Statement	<u>DATE</u>
Approval - Milestone O	June 1979
B. Milestone I	
C. Contractor Selection	*(September 1980)
D. Full Scale Development Initiation	*(March 1981)
E. Initial Flight Test	*(March 1981)
F. Release of Long Lead Items	*(July 1985)
G. Production Decision-DSARC III B	*(October 1985)
H. First Production Item	September 1984
I. Initial Operational Capability	May 1985
	December 1986
	October 1987

* Data presented in fiscal year 1981 Descriptive Summaries

EXPLANATION OF MILESTONE CHANGES: Delays have been experienced in the early stages of the program due to funding uncertainties and due to the administrative process in defining, coordinating, and promulgating contract requirements. The current acquisition strategy will recover this lost time by combining the Milestone I and Milestone II decision points. This deletes the typical demonstration/validation phase, and saves approximately two years of development time. The low technical risk of this program obviates the requirement for a demonstration phase where prototyping normally occurs. Some of the later milestones have moved to earlier dates due to a better definition of the program obtained through the Concept Exploration Phase Studies.

7. (U) Resources: Not Applicable

Budget Activity: Tactical Programs, #4
Program Element: #63228F, Next Generation Trainer Aircraft

Test and Evaluation Data

1. (U) Development Test and Evaluation:

(U) The Next Generation Trainer Development Test and Evaluation program is structured into two major divisions: contractor conducted tests and Combined Test Force conducted ground and flight tests. The contractor ground tests are planned, scheduled, directed and conducted by the contractor. These tests include Engineering Development, Component Verification/Pre-Qualification, Qualification/Preflight, Integration, and Acceptance. The Combined Test Force will incorporate contractor and Government test requirements into a single integrated plan, using contractor and Air Force flight crews. This program includes Flying Qualities Tests, Structural Tests, Performance, Propulsion and Fuel System Tests, Reliability, Maintainability, Availability and Logistics Supportability Tests, and Technical Order Verification.

(U) The primary objectives of Development Test and Evaluation are: verify the design of the Next Generation Trainer air vehicle and components; verify the performance of the Next Generation Trainer air vehicle and components; evaluate Next Generation Trainer support equipment, maintenance and operating procedures; acquire data to assess and support changes to other components of the Undergraduate Pilot Training System; identify Next Generation Trainer system deficiencies and evaluate changes resulting from tests; acquire data to support the Next Generation Trainer system production process.

(U) Next Generation Trainer is now in a concept exploration phase with multiple contractors investigating various alternatives. Therefore, the only Development Test and Evaluation accomplished to date are contractor initiated tests to investigate design concepts. The Next Generation Trainer Test Planning Working Group will provide guidance for Development Test and Evaluation during Full Scale Development. Development Test and Evaluation flight is planned to begin second quarter, fiscal year 1984.

(U) The Development Evaluation and Test program will encompass three Next Generation Trainer aircraft for flight testing. Except for data gathering equipment, Development Test and Evaluation, Operational Test and Evaluation, and production aircraft are similarly configured.

(U) The Air Force Flight Test Center will plan, coordinate, evaluate, and document Next Generation Trainer Development Test and Evaluation for the Air Force. The Air Force Test and Evaluation Center will plan, coordinate, evaluate, and document the results of Initial Operational Test and Evaluation and Follow-On Test and Evaluation. The service Program Manager is Richard W. Matzko. Contractors are to be determined.

Budget Activity: Tactical Programs, #4
Program Element: #63228F, Next Generation Trainer Aircraft

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center will manage the Operational Test and Evaluation of modified T-37 or replacement aircraft that will be developed under the Next Generation Trainer program. The Next Generation Trainer configuration is unknown at this time as the Next Generation Trainer Program Office will select one concept from a field of five competitors during the fourth quarter, fiscal year 1981. Full Scale Development is scheduled to start during the first quarter of fiscal year 1982 and the combined Development Test and Evaluation/Initial Operational Test and Evaluation test is scheduled to be conducted between second quarter of fiscal year 1984 and the third quarter of fiscal year 1985.

(U) Preliminary Initial Operational Test and Evaluation planning has identified the following operational evaluation areas:

(U) The Next Generation Trainer performance and operational suitability.

(U) The capability of Next Generation Trainer aircraft, with ancillary support, to effectively serve as a primary trainer in the Undergraduate Pilot Training system.

(U) The ability of support equipment and technical manuals to satisfy the operational requirement.

(U) The Full Scale Development Initial Operational Test and Evaluation test team will consist of personnel from Air Force Test Evaluation Center, Air Training Command, and Air Force Logistics Command. The primary test site will be Edwards Air Force Base, CA. Test aircraft, number to be determined, will be preproduction versions of the Next Generation Trainer.

3. (U) Systems Characteristics:

<u>Characteristics</u>	<u>Objective</u>	<u>Demonstrated</u>
Fuel/Time	Fuel for 1.5 hour formation flight at 15,000 feet, approach, 300 Nautical mile alternate diversion	To be determined

Budget Activity: Tactical Programs, #4
 Program Element: #63228F, Next Generation Trainer Aircraft

<u>Characteristics</u>	<u>Objective</u>	<u>Demonstrated</u>
Runway length	5,000 feet runway capability	To be determined
Cruise speed	Minimum cruise 300 knots at 25,000 feet	To be determined
Landing approach speed	Landing approach 90-110 knots	To be determined
Single engine rate of climb	400 feet per minute engine out rate of climb	To be determined
Climb capability	2,000 feet per minute rate of climb at 25,000 feet	To be determined
Cruise altitude	Sustained cruise up to 35,000	To be determined

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63230F

Title: Advanced Tactical Fighter
Budget Activity: Tactical Programs, #4

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
TOTAL FOR PROGRAM ELEMENT							
2472	Advanced Tactical Fighter Program	2,700 ¹	0	10,300	25,000	Continuing	Not Applicable
		2,700	0	10,300	25,000	Continuing	Not Applicable

1 Reflects recent reprogramming action of \$0.7 million.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Tactical Fighter (ATF) program (Previously Combat Aircraft Technology) will develop concepts and define required characteristics for the next generation tactical fighter aircraft. Because of the long lead times necessary to develop and field new aircraft (traditionally twelve years) we must begin now if we are to deploy a new fighter by the mid 1990s. Initial efforts will examine both an air-to-air and air-to-ground aircraft since, due to the changing threat, it is not possible to accurately predict the dominant mission requirements for the 1990s until the mid 1980s. This year's request will allow us to initiate concept development as the next step to the mission analysis work accomplished with FY 80 funds. The Advanced Tactical Fighter program is closely tied to the Combat Prototype program (PE 63242). The prototyping program is designed to flight test technical options for application in a new fighter aircraft for the 1990s.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Air Force will initiate concept definition studies with industry leading to a Milestone I decision and initiation of a competitive concept validation phase. Program is structured to permit systems selection in the mid-1980s from appropriate air-to-surface and air-to-air options.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	2,000	5,800	9,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63230F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Advanced Tactical Fighter

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Mission Area Analysis centering on the European as well as worldwide commitments clearly indicates that the Air Force will need to acquire new tactical aircraft systems in the early to mid-1990s. Three specific factors are paramount: (1) aging and normal attrition of current forces, (2) evolution of threat capabilities and (3) technological opportunities.

Current fighter force modernization, scheduled for completion in the mid to late 1980s depending on actual F-16 procurement, will not provide sufficient new airframes to displace the entire F-4 force. Escalating support costs will probably dictate continued retirement of F-4s even though this action will cause corresponding reductions in total force levels.

Evolution of threat capabilities will probably negate our current qualitative advantage in the air-to-air arena and may deny the low altitude sanctuary which has become an integral part of our air-to-surface tactics. New Soviet fighter aircraft are expected to have energy maneuverability characteristics equivalent to the F-16. Advanced look down/shoot down fire control systems and air-to-air missiles will give the Soviets the capability to engage our attack aircraft at low altitudes. Development of a second supersonic cruise aircraft could enable the Soviet air forces to operate in a flight regime where we could not challenge them effectively.

New technologies are emerging in aerodynamics, propulsion, materials, manufacturing techniques and avionics which will result in simpler, more reliable systems at significantly lower operating and acquisition costs. While some of these technical opportunities can be enjoyed through modification of existing systems, maximum utility can be realized through integration of several advanced technologies in a new system.

The most apparent and well documented deficiency in our tactical air power capability is the inability to attack targets at night and in-weather. Because of the immediacy of this need, the bulk of Air Force program efforts in the fighter area since the mid-1970s has been oriented towards solving this deficiency.

The Air-to-Surface Technology Evaluation and Integration Studies, completed in 1978, found that effectiveness and efficiency of attack aircraft could be enhanced by operating at low altitude with a stealthy vehicle or at high altitude and supersonic speed (1.8-2.2 Mach above 50,000 feet). Improvements in supersonic technology suggest the latter approach is achievable in the 1990s. While the F-15 and F-16 aircraft are currently superior to threat fighters, the next generation of Soviet aircraft could be equal to or better in many aspects and the flexibility of the Tactical Air Force could be severely limited. Normal growth of the F-15 and F-16 systems with improved weapons and avionics should be able to maintain their qualitative superiority into the late 1980s.

The Air Force needs to start now to acquire new tactical aircraft for the 1990s. Normal lead time required to achieve initial operational capability of a new fighter is about 12 years including the front end concept development work. Full scale engineering development and initial production of the selected configuration historically requires six to seven years. This indicates that the systems acquisition decision on a new fighter must be made no later than FY 87 if we are

Program Element: #63230F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Advanced Tactical Fighter

Budget Activity: Tactical Programs, #4

to achieve a significant operational capability by the mid-90s. Concept development and technology validation work to support this major systems acquisition decision needs to be pursued during the early 1980s in order to fully understand evolving threat capabilities and mission requirements. The Air Force development effort in the Advanced Tactical Fighter program is structured to develop both the air-to-air and air-to-surface requirements and technical base so that appropriate options are available when a clearly defined acquisition decision becomes necessary in the mid-1980s.

(U) RELATED ACTIVITIES: The Air Force has developed a structured approach to address deficiencies in night, adverse and in-weather attack capabilities against mobile targets. The primary program elements that address these deficiencies are the Advanced Tactical Fighter and the Low Altitude Navigation and Targeting Infrared System for Night programs. The primary thrust of the Advanced Tactical Fighter program is to develop the next generation tactical fighter aircraft. The aircraft will be characterized by high mission effectiveness, increased survivability, and a quantum improvement in cost effectiveness and affordability, both in acquisition and operating costs. The Low Altitude Navigation and Targeting Infrared System for Night program will provide a highly effective near to mid-term capability for attack at night and low altitude, under-the-weather conditions. The Advanced Tactical Fighter program is closely tied to the Combat Aircraft Prototype program (PE 63242) which will maintain our technical capability to meet the needs of the next generation fighter. This program will design and build new prototype aircraft every two years beginning in FY 82. The prototype program schedule has been designed to support the Advanced Tactical Fighter program which is expected to enter full scale engineering development about 1987. Flight testing of the first prototype will be completed by FY 84 while the second prototype will complete flight testing by FY 86. These prototypes will validate new aeronautics and propulsion technologies and will contribute directly to the major configuration decisions for the next generation fighter.

(U) WORK PERFORMED BY: Pre-Milestone 0 and Concept Definition studies will be managed by the Air Force Systems Command/Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. Contracts for concept definition studies have not yet been awarded.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Initiation of mission analysis studies for an advanced tactical fighter and development of a Mission Element Need Statement for the air-to-surface requirement.

2. (U) FY 1981 Planned Program: The Air Force will submit a MENS to OSD for the air-to-air and air-to-surface requirement.

Program Element: #63230F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Advanced Tactical Fighter

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program: Initiation of concept definition studies with industry leading to a Milestone I decision and initiation of a competitive concept validation phase.

4. (U) FY 1983 Planned Program: Concept validation phase continues.

5. (U) Program to Completion: Entry into full scale engineering development for an advanced tactical fighter in the mid-1980s leading to an Initial Operational Capability in the mid-1990s.

6. (U) Milestones:

	<u>Date</u>
a. Air-to-surface mission analysis contract award	Dec 1979
b. Air-to-surface mission analysis contract award	May 1980

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63239F

DOD Mission Area: Tactical Surveillance Reconnaissance
and Target Acquisition, #255

Title: Advanced Tactical Air Reconnaissance System (ATARS)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

<u>Project Number</u>	<u>Title</u>	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	TOTAL FOR PROGRAM ELEMENT			3,100	4,200	93,900	101,200

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Advanced Tactical Air Reconnaissance System or ATARS, is an advanced development program to meet the needs of tactical commanders for detection, location and classification of tactical targets during all light and weather conditions with sufficient location accuracy, detail and timeliness to permit the delivery of appropriate air or ground launched weapons. The requirement is based on short falls that exist in the

the from being candidates for need satisfaction. It does not preclude platforms such as considered for cueing and as part of a complementary reconnaissance mix. Existing collection systems are considered for a complementary reconnaissance mix. The draft Mission Element Need Statement (MENS) is a undergoing review by the Office of the Secretary of Defense (OSD).

(U) BASIS FOR FY 1982 RDT&E REQUEST: Begins advanced development, concept definition of alternative platform and sensor candidates through multiple contractual study efforts. Results will lead to selection of up to two alternatives for demonstration and validation beginning in FY 1984. The program funding profile was developed by Air Force Systems Command based on comparisons with other concept definition studies and prototyping efforts.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>

Not Applicable, new start in FY 1982

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63239F

DOD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: Advanced Tactical Air Reconnaissance System (ATARS)

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop a survivable tactical reconnaissance capability which allows commanders to supplement standoff data, when available, to obtain precise target identification and location in a timely manner. The contractual studies will analyze a variety of alternative solution candidates including both manned and unmanned systems, as well as sensor configurations and interfaces with the Tactical Air Intelligence System. Studies will address systems survivability, life cycle costs, technological opportunities, data dissemination and exploitation and operational utility. At least one alternative system will be recommended for prototype testing and demonstration leading to a full-scale engineering development decision in FY 1988.

(U) RELATED ACTIVITIES: The program uses the results of preliminary study efforts conducted during FY 1981 under Program Element 63101F to identify potential solution candidates for fulfilling the need for tactical target execution information. Sensor developments conducted under Program Elements 63208F and 64710F will be considered as potential sensor candidates. Coordination will be maintained with the potential Navy reconnaissance development conducted under Program Element 63261N.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson Air Force Base, OH has the overall management responsibility for conceptual systems development. Coordination with Rome Air Development Center, Griffis Air Force Base, NY will be maintained to ensure consideration of electronic sensor systems. Contractors for the conceptual phase will not be selected until FY 1982, but multiple study contracts are planned.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable
2. (U) FY 1981 Program: Not Applicable
3. (U) FY 1982 Planned Program: Begin concept formulation and evaluation of systems alternatives
4. (U) FY 1983 Planned Program: Complete concept formulation and select system(s) for prototype demonstration and concept validation.
5. (U) Program to Completion: Conduct prototype demonstration and testing leading to full-scale engineering development decision in FY 1988.
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63242F
 DOD Mission Area: Air Warfare, #220

Title: Combat Aircraft Prototype
Budget Activity: Tactical Programs, #4

(U) RESOURCES (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		0	0	22,500	25,600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Combat Aircraft Prototype program will provide the technical options and design competence necessary to ensure that future fighter development programs can be responsive to evolving mission needs. This program will develop manned flight test aircraft to demonstrate and validate promising technology initiatives pertinent to critical mission tasks. This program will ready new technologies for full scale engineering development, will reduce the growing gap between technology development and operational introduction and will maintain the U.S. aerospace industry design capability.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Begin engineering design and development of initial flight test aircraft. Funding will essentially complete detailed design and will initiate design verification and fabrication of the prototype aircraft. Cost estimate is based on recent industry proposals (e.g. F-16XL and forward swept wing designs) to accomplish flight test verification of significant aeronautics technology initiatives on manned aircraft.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63242F

DOD Mission Area: Air Warfare, #220

Title: Combat Aircraft Prototype
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Combat Aircraft Prototype (CAP) program is closely tied to advanced fighter developments and has important implications for the ability of the technology base to be responsive to the needs of future operational aircraft. Long range planning for the tactical fighter force indicates that a new fighter aircraft design will need to be introduced in the early 1990's. This need is based on projected drawdown of the fighter force structure, improvements in threat capabilities and evolution of tactical mission requirements. In order to achieve an initial operational capability of a new fighter by the mid 1990's, detailed mission requirements and appropriate technology options must be developed in time to start full scale engineering development in the 1986-87 time frame. Mission requirements are being developed under the Advanced Tactical Fighter program (PE 63230F) to meet this schedule; however, the technology options needed to achieve necessary performance capabilities will not be available at the desired time unless pertinent technology demonstrations can be undertaken during the first half of the 1980's. During the period since the development of the F-15 and F-16 in the early 1970's, many attractive technology initiatives have emerged, but these technologies have generally not been subjected to the actual flight verification necessary to insure that they can be introduced into future aircraft with acceptable risk. Furthermore, during the current unprecedented gap in U.S. fighter developments, industry design teams have not been afforded the essential experience involved in translating design concepts into actual flight hardware. Unless resolved, these two factors will significantly increase the risk associated with development of a future fighter aircraft. The Combat Aircraft Prototype (CAP) program is needed to maintain U.S. industrial design and fabrication capability in fighter aircraft and to insure that the technical options required in future fighter development programs will be available when needed.

(U) The CAP program will develop manned flight test aircraft for verification of promising technology initiatives. The program will demonstrate improvements in aircraft capabilities to perform tasks pertinent to future mission requirements and will prepare appropriate technologies for entry into full scale development. This effort will provide continuing opportunities to industry to fully exercise advanced design and vehicle fabrication teams and will reduce the growing gap between the initial emergence of technologies and their operational introduction. The successive starts of flight test programs at discrete intervals envisioned under the CAP program will also provide a focus for government and industry technology base programs. Fast-paced, closed ended schedules (three years to completion) are planned for each effort to insure that the program remains responsive to technology innovation and evolving mission requirements. Competitive contracting will be a used to gain broad industry participation in each design process.

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Program Element: #63242F

DDO Mission Area: Air Warfare, #220

Title: Combat Aircraft Prototype
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The Combat Aircraft Prototype (CAP) program is related to aeronautics technology base programs including Aerospace Flight Dynamics, (PE 6220IF), Flight Vehicle Technology (PE 6320SF) and Advanced Fighter Technology Integration (PE 6324SF). CAP is also related to the Advanced Tactical Fighter program (PE 63230F). The CAP program provides a link between technology developments in the exploratory and advanced development stages and the full scale engineering development of weapons systems. CAP will use functional technology items developed in the technology base by integrating them into a vehicle capable of accomplishing mission related tasks, and will provide flight demonstration/ validation of the capabilities derived from these technologies. CAP uses technologies validated in the Advanced Fighter Technology Integration (AFTI). CAP expands AFTI and other technology development efforts by focusing design goals on achieving improvements in mission task capabilities. AFTI focuses on discrete technology items and provides for integration and flight testing of various technologies to evaluate the capabilities available from the combined technologies. AFTI will provide integrated technology sets to feed into the CAP vehicles, and is critical to maintaining the fast-paced schedules envisioned for CAP. The CAP program will allow design teams maximum latitude in applying technology developments to accomplish a specified job. The mission performance demonstrated under CAP will define the technological capability to achieve required performance in future operational aircraft. The AFSC planning process (Vanguard) insures that CAP, AFTI and related technology base programs support rather than duplicate each other. Coordination between CAP and the Advanced Tactical Fighter program is maintained by including the operational commands in the planning process for CAP.

(U) WORK PERFORMED BY: Work under this program is managed by the Aeronautical Systems Division of AFSC in conjunction with the Wright Aeronautical Laboratories. The flight test effort under this program will be conducted at the Air Force Flight Test Center. This program will use various government aeronautics research and development facilities. No contracts have been awarded under this program. Potential bidders are the major U.S. airframe manufacturers including Boeing Aerospace Corp, Seattle, WA; Fairchild-Republic Company, Farmingdale, Long Island, NY; General Dynamics Corp, Fort Worth, TX; Grumman Aircraft Company, Bethpage, NY; Lockheed California Company, Burbank, CA; McDonnell Aircraft Company, St Louis, MO; Northrop Corp, Hawthorne, CA; Rockwell International, Los Angeles, CA; and Vought Corp, Dallas, TX.

Program Element: #63242F

DOD Mission Area: Air Warfare, #220

Title: Combat Aircraft Prototype
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHED AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable

2. (U) FY 1981 Program: Not Applicable

3. (U) FY 1982 Planned Program: The FY 1982 program will initiate the first prototyping effort under the Combat Aircraft Prototype (CAP) program. Activities will include evaluation of industry proposals, selection of appropriate design(s), negotiation and award of contracts, and initiation of detailed design and fabrication of the initial prototype vehicles. Detailed design, design validation and procurement of materials will be largely completed in FY 1982. Fabrication of subcomponents will be initiated as permitted by design maturity. Definition studies of possible follow-on efforts will also be initiated in FY 82.

4. (U) FY 1983 Planned Program: Complete detailed design and fabrication of first prototype vehicles. Conduct vehicle ground testing to verify structural integrity and subsystem operation prior to first flight. Complete definition studies for follow-on effort. Prepare statement of work and Request for Proposal for follow-on effort. Evaluate proposals, select design concepts and negotiate contract(s) for follow-on prototype as appropriate.

5. (U) Program to Completion: This is a continuing program. Flight test of first prototype will be conducted during FY 1984. First prototype effort will terminate at the end of FY 1984. Follow-on effort will award contract(s) and initiate detailed design, design verification and fabrication of second prototype vehicles. Concept definition studies for third prototyping effort will also be initiated in FY 1984. Second prototype effort will complete fabrication in FY 1985 and complete flight test in FY 1986. Contract award of third prototype effort will occur in FY 1986. Prototyping cycle will recur every three years.

6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63244F
 DOD Mission Area: Air Warfare Support, #225

Title Aircraft Nonnuclear Survivability
Budget Activity Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
		1,486	1,290	1,700	1,900	Continuing	Not Applicable
TOTAL FOR PROGRAM ELEMENT							

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the resources for the Air Force's participation in the Joint Logistics Commanders' Joint Aircraft Survivability Program. The Naval Material Command and the Army Material Development and Readiness Command are co-sponsors and contributors to the program. The program develops design guidance and technology for improving the combat survivability of United States aircraft to nonnuclear threat weapons as well as standard, triservice-approved vulnerability and survivability assessment methodology. Program outputs are used by Product Divisions, Program Offices, Laboratories and Contractors who build Aircraft Weapons Systems.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Based upon analysis of combat experience in Southeast Asia and intelligence gathered from the 1973 Mideast conflict, the Joint Technical Coordinating Group for Aircraft Survivability, in conjunction with the Research and Development organizations of the logistic commanders of the three Services, developed an overall technology plan to provide the knowledge required for the design of combat survivable aircraft and equipment. This is a level of effort program that funds the Air Force portion of this overall plan at a level agreed to by the Joint Logistics Commanders.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	700	1,300	1,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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Program Element: #63244F

DOD Mission Area: Air Warfare Support, #225

Title Aircraft Nonnuclear Survivability
Budget Activity Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: In 1971, a Joint Technical Coordinating Group on Aircraft Survivability was established under the Joint Logistics Commanders to acquire and make available technology for designing nonnuclear survivability into new aircraft. The charter of this group is (1) to implement interservice efforts to reduce non-nuclear vulnerability of aircraft; (2) to coordinate research and advanced development in nonnuclear survivability; and (3) to maintain liaison between technology experts and those actually designing new aircraft. In the fall of 1972, the Joint Technical Coordinating Group on Aircraft Survivability formulated a triservice nonnuclear survivability program named Test and Evaluation Aircraft Survivability which was approved by the Under Secretary of Defense for Research and Engineering with \$10 million being allocated for the program over a three year period (FY 1973 - FY 1975). As a technology-oriented program, the Test and Evaluation Aircraft Survivability program performed testing to strengthen the data base, evaluated prototype hardware and developed engineering theory and design criteria. In early FY 1975, a decision by the Under Secretary of Defense for Research and Engineering called for further nonnuclear survivability efforts to be budgeted by each of the Services beginning in FY 1976 with interservice coordination to continue under the Joint Technical Coordinating Group on Aircraft Survivability. The objective of this program element is to support the Air Force portion of the overall nonnuclear survivability efforts of the Department of Defense. As such, it will be a level of effort program coordinated with an' complementary to Army and Navy programs.

(U) RELATED ACTIVITIES: This program element is related to complementary programs of the Army (PE #63215A) and Navy (PE #63262N) and to Air Force programs to design aircraft with improved survivability in nonnuclear threat environments. The coordination of these efforts is through a central management office of the Joint Technical Coordinating Group on Aircraft Survivability which is manned by an officer for each command represented on the Joint Logistics Commanders Group. Duplication is avoided through joint reviews by that office and the individual Service task agencies. Program is also related to survivability efforts in Aerospace Flight Dynamics (PE #62201F), Aerospace Propulsion (PE #62203F) and Materials (PE #62102F).

(U) WORK PERFORMED BY: The Air Force Systems Command, Andrews Air Force Base, MD, has lead responsibility for the Air Force nonnuclear survivability program. Subordinate units performing work are the Air Force Flight Dynamics Laboratory, the Air Force Aero Propulsion Laboratory, the Air Force Avionics Laboratory, and the Aeronautical Systems Division. All of these organizations are at Wright-Patterson Air Force Base, OH. Major contractors are General Electric Company, Cincinnati, OH; The Boeing Company, Seattle, WA; Systems Research Laboratories, Dayton, OH; Booz Allen Applied Research, Bethesda, MD; University of Dayton Research Institute, Dayton, OH; Vought Corporation, Dallas, TX; and COMARCO Incorporated, Ridgecrest, CA.

Program Element: #63244F

DOD Mission Area: Air Warfare Support, #225

Title Aircraft Nonnuclear Survivability

Budget Activity Tactical Programs #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Completed survivability/vulnerability assessment methodology for parked aircraft in FY 80. Developed optimized armor for defeating 23mm armor piercing projectiles. Injected survivability as a design tradeoff parameter in the Multiple Applications Core Engine program. Completed coordination on two Military Standards for aircraft survivability. Updated survivability attrition model with human controller response of additional threat weapons. Prior accomplishments include development of design criteria for survivable fuel cells, determination of the minimum effective concentration of inerting gases required to protect F-16 fuel tanks against 23mm high explosive incendiary projectiles, development of analysis methods to predict behavior of structural composite materials to nonnuclear combat damage, demonstration of a compartmentalized lubrication system for vulnerability reduction of the F-100 engine, completion of an A-10 combat damage repair time prediction analysis, and development of an improved fire extinguishing agent for use in the high airflow environment of combat damaged engine nacelles.
2. (U) FY 1981 Program: Technology efforts are being performed in the areas of armor, fire protection, propulsion, structures and countermeasures. An armor configuration is being developed for protection against 57mm high explosive projectiles. Chemical powder packs are being evaluated and optimized for fire protection in aircraft void areas. Design guides for control of radar cross section and for attachment and repair of armor systems are being developed. Reduction in infrared signature of turbine engines is being investigated. Bonded structures are being tested for ballistic and thermal tolerance. Fragment penetration equations for advanced composite materials are being developed. Protection for infrared imaging systems against lasers is being developed. Guides to effect improvement in the quality of infrared measurements are being written. Feasibility study for increasing survivability by multiplexing electronic countermeasures and radar systems is being performed. Methodology and data base is being developed for aircraft battle damage repair assessment. Simplified vulnerability analysis procedures are continuing to be developed. Data base on laser effects on materials is being expanded. The state of the art in survivability assessment continues to be advanced by studies of survivability against laser beam rider missiles and integration of electro-optical countermeasures effectiveness into tradeoff models. Surface-to-air missile models and an air combat simulation model are being updated. Systematic documentation is being provided and advances in aircraft survivability are being disseminated to government agencies and industry.
3. (U) FY 1982 Planned Program: The following tasks will be continued into FY 1982. Armor protection against 57mm high explosive projectiles, chemical powder pack fire protection, infrared signature reduction for turbine engines, development of fragment penetration equations for composites, infrared imaging system protection against lasers, improvement in infrared measurements, multiplexing electronic countermeasures and radar systems, aircraft battle damage repair assessment methodology and data base, laser effects data bases, survivability against laser beam rider missiles, electro-optical countermeasures integration into tradeoff models, and surface-to-air and air combat model updates. Documentation will continue to be provided and advances in survivability disseminated. New tasks being considered are

Program Element: #63244F

DOD Mission Area: Air Warfare Support, #225

Title Aircraft Nonnuclear Survivability
Budget Activity Tactical Programs #4

Develop advanced design guide and supporting test data for minimizing radar cross section, threat warhead fragmentation characterization, develop component vulnerability ballistic resistance data base, develop combat damage repair survivability assessment tradeoff methodology, and develop optimum aircraft trajectories for survivability against ground-to-air threats. FY 1982 resources have been decreased from \$1,900 thousand to \$1,671 thousand to fund higher priority programs.

4. (U) FY 1983 Planned Program: The following tasks are planned to be continued into 1983: Chemical powder pack fire protection, infrared signature reduction for turbine engines, development of fragment penetration equations for composites, improvement in infrared measurements, aircraft battle damage repair data base, and laser effects data bases, surface-to-air missile model update, advanced radar cross section design guide and test data, threat warhead fragmentation characterization, component vulnerability ballistic resistance data, combat damage repair survivability assessment tradeoff methodology, and optimum survivable aircraft trajectory development. Documentation will continue to be provided and advances in survivability disseminated. New tasks being considered are System verification of 57mm armor protection, evaluate survivable electric power flight control actuation concept, evaluate effectiveness of battle damage repair methods for composite structures, and validation of surface-to-air missile computer model.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63249F

Title: Night Attack Program
Budget Activity: Tactical Programs, #4

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	1/ FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,101	4,400	3,100	0	0	8,600
2628	Millimeter Wave (MMW) Technology	1,101	4,400	3,100	0	0	8,600

1/ Excludes funding for the Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) now included in Program Element 64249F, Night/Precision Attack.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION: The FY 1982 Night Attack Program has a single project, a feasibility flight test demonstration of a millimeter wave radar. The demonstration consists of evaluating the potential of a millimeter wave radar to provide a high resolution, low cost fire control radar. The 95GHz radar being evaluated was developed under US Army contract for the Aquila Remotely Piloted Vehicle Project. The radar and displays are being modified to enable low altitude penetration, target acquisition and weapon delivery/gun pointing, compatible with night/adverse weather conditions in the Air Force's air-to-surface interdiction and close air support missions. It responds directly to an enemy ground attack threat which is continually growing in both quantitative and qualitative terms. The Air Force needs for improved night air-to-surface attack capability are specified and documented in the Air Force Planning Guide Mission Area Analysis, 1 December 1979.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Night Attack funding request will complete radar/avionics modifications, initiate and complete contractor ground tests, and begin actual flight testing. Costs shown are based on contractor cost estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable (see page 3, paragraph 8)

(U) OTHER APPROPRIATION FUNDS: None

(625)

625

Program Element: #63249F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Night Attack Program

Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The threat posed by the enemy's formidable armored and air forces, especially of the Warsaw Pact against the North Atlantic Treaty Organization (NATO), has increased in the past few years and is projected to become stronger in both quantitative and qualitative terms. Enemy armor, equipped with night vision capability and accurate laser ranging systems, has been combined with new hardware, training and operational doctrine to assure a continued enemy thrust during night and adverse weather conditions. Successful interdiction and close air support missions against this projected threat require accurate target acquisition and weapons delivery. Even though target acquisition, laser designation and attack capability currently exist for day visual conditions, serious deficiencies occur when these tasks are required to be performed during night and adverse weather conditions. The need is well documented in several sources including the Air Force Planning Guide, Mission Area Analysis, 1 Dec 1979 and NATO Rationalization, Standardization, Interoperability (RSI) Master Plan, 5 Sep 1979. This program is primarily dedicated to improving Air Force capability to conduct close air support and interdiction missions at night and in limited adverse weather across the spectrum of existing aircraft.

(U) MILLIMETER WAVE TECHNOLOGY: This project's objective is a feasibility flight demonstration of low cost night/adverse weather capability. Millimeter wave radar demonstration includes terrain avoidance/blind letdown, short-range target acquisition and fire control system for night/adverse weather attack. The concept includes a millimeter radar sensor, processor and a Heads-Up Display (HUD). The millimeter sensor provides search and detection of moving and stationary targets at night and in a wide range of limited adverse weather conditions. The radar processor will detect moving targets and select high density target areas for display on the Heads-Up Display. The pilot then selects a target of interest, cues the radar via the hand controller and flies the resulting HUD commands to the target. The fire control system will track the designated target and provide gun firing or weapons release command to the pilot. The millimeter radar system may also provide a terrain elevation profile interleaved with the target search mode. A terrain profile would provide blind descent through clouds and safe flight at low altitude. This project does not develop a millimeter radar. It adapts an existing millimeter radar to an aircraft fire control system and cockpit display. This project is the only millimeter airborne fire control program which is investigating this technology for use on tactical Air Force aircraft.

(U) RELATED ACTIVITIES: The Low Altitude Navigation and Targeting Infrared System for night project will develop a dedicated terrain following radar and a navigation and targeting Forward Looking Infrared Receiver for fire control. The millimeter wave radar which was developed by the Army for the AQUILA mini-Remotely Piloted Vehicle Program will be used in the Millimeter Wave Technology project. There is a joint Defense Advanced Research Projects Agency (DARPA)/Air Force program investigating both X-band and millimeter wave radar. Data from this program will be used for the Millimeter Wave Technology project.

(U) WORK PERFORMED BY: All Air Force efforts will be managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The contractor modifying the hardware and conducting the flight test is Norden Systems, Inc, Norwalk, Conn.

Program Element: #63249F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Night Attack Program
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 Program: The Millimeter Wave Radar project began with the signing of a Memorandum of Agreement with the Army for the use of existing radar hardware developed by the Army. The necessary radar and avionics modifications for the Air Force flight test began.
2. (U) FY 1981 Program: The major tasks for FY 1981 include development of flight test support equipment and continued radar modifications for pod installation.
3. (U) FY 1982 Program: In FY 1982 the radar/pod integration will be completed. The pod will be mounted on a T-39 for the beginning of the feasibility flight test demonstration.
4. (U) FY 1983 Program: The flight test demonstration results will be evaluated for further development or for operational testing.

5. (U) Program to Completion: Undetermined.

6. (U) Milestones: Not applicable.

7. (U) Resources (\$ in thousands):

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,100	4,400	3,100	0	0	8,600
Procurement		NONE				

8. (U) Comparison with FY 1981 Budget Data:

1/

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,100	19,500	9,200	0	0	29,800
Procurement		NONE				

1/ The FY 1981 Descriptive Summary listed additional projects. The Low Altitude Navigation and Targeting Infra-red System for Night (LANTIRN) project was transferred to a new Program Element 64249F. The Terrain Following Radar and Single-Seat Laser Designator projects were terminated in accordance with FY 1981 Authorization Conference guidance. This funding line along with the same line in Program Element 64249F (LANTIRN) equate to the total funding shown in the FY 1981 Descriptive Summary.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63253F

Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		-	600*	6,900	25,900	Continuing	Not Applicable
2734	Advanced System Avionics	-	-	3,665	10,900	Continuing	Not Applicable
2735	Integrated Flight Demonstrator	-	-	1,400	10,100	Continuing	Not Applicable
2538	Integrated Communication-Navigation-Identification Avionics	-	600*	1,835	4,900	55,365	62,700

*Project 2538 was transferred from Program Element 63727F, effective in FY 1982.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current avionics systems are major contributors to inadequate weapon system reliability and represent a substantial and increasing fraction of aircraft acquisition and support costs. The PAVE PILLAR program will exploit a number of recent innovations in systems architecture, semiconductor technology, computer standardization, and computer software to integrate the avionics functions of an advanced aircraft to obtain very high mission reliability, fault tolerance and substantial reductions in both acquisition and support costs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Provides funds to:

- Finalize the system definition of an integrated communication, navigation, identification system for both retrofit and future aircraft applications. This effort will assess two different technologies as solutions to the size, weight and cost reductions necessary to make communications, navigation, and identification systems affordable.
- Begin design studies of an Integrated Flight Demonstrator testbed aircraft and associated instrumentation suitable for low cost testing of an integrated avionics system.
- Initiate design and development of an integrated core avionics suite that uses advanced concepts such as program-mable color displays, high speed fiber optic multiplex busses, fault tolerant computer architectures and avionics software written in Ada, the Department of Defense standard higher order computer programming language. Cost estimates are based on studies performed under the Multi-Frequency/Multi-Band Radio project in Program Element 62204F, and from historical cost data on the Advanced Fighter Technology Integrator program and other flight test programs of similar complexity.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Projects 2734 and 2735 are new starts in FY 82. Project 2538 was transferred from PE 63727F, effective in FY 82.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63253F

Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force is conducting a concerted engineering and management effort to contain the rising cost, complexity, and proliferation of airborne electronic equipment (avionics) through a comprehensive program of avionics planning, standardization, and control. Toward this end, AFR 800-28 which outlines new policies on acquisition and support, was published in September 1978. A Deputy for Avionics Control has been established to carry out avionics policy as stated in AFR 800-28. The thrust of this effort is directed towards application of a family of standard architectures to avionics systems in order to enhance responsiveness to new threats and thereby improve capability and survivability. The standard architectures will be based upon the concept of common, shared resources which are transferable across aircraft types and missions. An early attempt at such an architecture was the concept successfully demonstrated under Program Element 63243F, Digital Avionics Information System. The Digital Avionics Information System utilized a "core" avionics approach in which all on-board avionics shared common processing resources, a common multiplex data bus, a common set of controls and displays, and, in some cases, common software programs. The system was designed in such a way that modules related to a given avionic function can be removed, updated and replaced without altering the function of other on-board subsystems. Under such a concept, retrofit becomes much less difficult and substantially less expensive since the manhours required to install a retrofit system can be reduced by as much as 90 percent. Evolving from the Digital Avionics Information System program were: MIL-STD-1750A, the Air Force Standard 16-bit Computer Instruction Set Architecture; the MIL-STD-1589B, Air Force Standard Higher Order Language (J73); and MIL-STD-1553B Department of Defense Multiplex Data Bus Standard. These three standards form the architectural basis for all avionics development and retrofit programs. The PAVE PILLAR Program, scheduled to start in FY 1982, will address functional integration employing a maximum of commonality and standardization. The avionics community has accepted the fact that the only cost effective approach to our present-day problems of proliferation, nonstandardization and unacceptable mission reliability of avionics systems is increased functional integration. All electronic subsystems on board the aircraft must be effectively tied together to operate as a system. The PAVE PILLAR Program will initially contain three projects. The first, entitled Advanced System Avionics will serve as the key project and will (1) investigate methods of using avionics for operations at night and in weather where maximum reliability and graceful degradation are mandatory requirements for the entire avionics system, (2) develop design specification for companion integrated support facilities, (3) develop a family of software compatible avionics computers for embedded applications in future systems, and (4) provide Life Cycle Cost parameters for use in design of candidate systems/subsystems and support facilities. The second project, entitled Integrated Flight Demonstrator will provide an airborne test bed for candidate systems under development. The third project, entitled Integrated Communications Navigation-Identification Avionics represents the first attempt at both radio systems integration and the integration of those previously autonomous communication, navigation, and identification subsystems into the core avionics system of the aircraft. Benefits to be derived include software/hardware standardization, a 50 percent reduction in size/weight/power, and the provision of data for Life Cycle Cost analyses. Additional subsystem integration projects will be added in the future. These will include electronic warfare, flight control, stores management and propulsion systems.

(U) RELATED ACTIVITIES: Exploratory development is presently underway in Program Element 62201F, Aerospace Flight Dynamics, and Program Element 62204F, Aerospace Avionics, which will provide near-term support for the program. The outputs of Program Element 63243F, Digital Avionics Information System will serve as the basis for the initial effort.

Title: Advanced System Integration Demonstrations (PAVE PILLAR) #551
Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: The work will be managed by the Air Force Wright Aeronautical Laboratories, Avionics Laboratory at Wright-Patterson Air Force Base, OH. Virtually any competent avionics firm in the world is a candidate to participate in contractual efforts to follow.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This program is an FY 1982 new start. Baseline architecture and standards were provided by advanced and engineering development accomplishments under Digital Avionics Information System and Integrated Digital Avionics respectively. Program Element 62204F, Aerospace Avionics, has contributed several inputs to be investigated, such as Integrated Head-Up Display, Airborne Electronic Terrain Map, AN/AYK-15A Computer, and MIL-STD-1750A Instruction Set Architecture Studies. Program Element 63727F has contributed the front-end study efforts required for initiation of the Integrated Communications-Navigation-Identification Avionics Project.
2. (U) FY 1981 Program: Preparation and planning will continue through FY 1981 in anticipation of actual program start in FY 1982. Efforts in Program Element 62204F will continue. All hardware and software developed under Digital Avionics Information System will be configured to support a PAVE PILLAR start in FY 1982. Efforts will continue on Integrated Communications-Navigation-Identification Avionics under Program Element 63727F with the initiation of dual award system definition contracts and the start of a contractual effort to define the Integrated Communications-Navigation-Identification Avionics Evaluation Facility.
3. (U) FY 1982 Planned Program: The Advanced System Avionics project will initiate efforts as follows: (a) Integrated Operational Systems Simulation, (b) Advanced Architecture Design, (c) Integrated Support Facility Development, (d) Embedded Computer Family application, (e) Flight Hardware Development, (f) Software Support Tools Development, and (g) Life Cycle Cost studies. Part of the Advanced Architecture Design effort will be the development of a high speed digital fiber optic databus standard for multi-computer applications. The Integrated Flight Demonstrator Project will initiate the following efforts: (a) System Design and Integration, (b) Hardware Development and Acquisition, and (c) Software Modification and evaluation facility design. The Integrated Communications-Navigation-Identification Avionics Project will complete system definition and evaluation facility design.

Program Element: #63253F

Title: Advanced System Integration Demonstrations (PAVE PILLAR)
DoD Mission Area: Electronics and Physical Sciences, #551
Budget Activity: Tactical Programs, #4

4. (U) FY 1983 Planned Program: Efforts initiated in Advanced System Avionics and Integrated Flight Demonstrator in FY 1982 will continue. A demonstration of a night strike mission with avionics subsystem failures and graceful degradation is planned in late FY 1983. The Integrated Communications-Navigation-Identification Avionics Project will award contracts for the development of the Evaluation Facility and will award either a single or dual award contract (based upon evaluations of technical risk, the potential for technological breakthroughs, and the need to maintain competition) for the design, fabrication and integration of the Integrated Communications-Navigation-Identification Avionics subsystem.
5. (U) Program to Completion: PAVE PILLAR provides a foundation of facilities and organizational expertise for evolving new architectural concepts, developing interface standards, and integrating advanced avionics into the systems of today and tomorrow. It will allow early, low cost assessments of advanced avionics concepts through a combination of laboratory simulations and flexible flight testing.
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63313F
DOD Mission Area: Counter Air, #221

Title: Advanced Missile Subsystem Demonstration
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total	
							Estimated Costs	Applicable
TOTAL FOR PROGRAM ELEMENT								
2697	Ducted Rocket Motor		3,300	6,000	7,000	Continuing		39,300

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is designed to demonstrate capabilities of advanced air-to-air tactical missile subsystems through flight test. Selected subsystems are integrated with a test missile program configuration and flight tested to prove new developments and allow intelligent, low-risk decisions on future tactical missile systems to meet the expanding threat. Emphasis will be placed on selecting those subsystems which can be utilized in current and projected tactical missiles.

(U) BASIS FOR FY 1982 RDT&E REQUEST: One effort will be pursued during this period. The Ducted Rocket Motor is a new propulsion system concept which has the potential to significantly increase the range and average speed of tactical air-to-air missiles. Includes funds to continue the demonstration and flight test of the Ducted Rocket Motor concept in a 300 pound class missile. Request is based on Air Force Aero Propulsion Laboratory estimate of funds required to accomplish work tasks specified in current contract with Hughes Aircraft Corporation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total	
					Estimated Costs	Applicable
	6,500	9,200		Continuing		

RDT&E

The FY 1981 request was denied by the House Appropriations Committee, supported by the Senate Appropriations Committee, and approved at one half the requested level by the Conference Committee. Impact of the reduction is delay in starting a Passive/Active Radar Seeker project and slowdown of Ducted Rocket Motor project. FY 1982 difference reflects delay of seeker project.

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Project: #2697

Program Element: #63313F

DDO Mission Area: Counter Air, #221

Title: Ducted Rocket Motor

Title: Advanced Missile Subsystem Demonstration

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Development of the Ducted Rocket Motor technology was initiated in 1976 with exploratory work on gas generator fuels. Since that time, exploratory programs have developed additional fuels, flight weight combustors, and insulators. Successful engine performance has been demonstrated in ground, direct connect tests. Based on this successful exploratory effort and the need to fully demonstrate this new technology, a flight test program was initiated in September 1978. At that time, a plan was established for initial funding out of the Aero Propulsion Laboratory, Program Element 63302F, for further ground testing of the Ducted Rocket Motor for the development of flight qualified hardware. This program element (63313F) will fund the flight test effort. Successful flight demonstration of the Ducted Rocket Motor propulsion concept will provide medium range class tactical missiles with higher average speed to target, increased payload capability, longer range, or smaller size than solid rocket propulsion systems. Demonstration and evaluation of engine performance, missile performance limits, propulsion cost, and engine reliability will be an integral part of this program.

(U) RELATED ACTIVITIES: Ducted Rocket Motor ground test and component development, and propulsion test vehicle design and development were initiated in Program Element 63302F, Advanced Missile Propulsion. Successful demonstration of the Ducted Rocket Motor provides an option for an enhanced variant of the Advanced Medium Range Air-to-Air Missile, Program Element 64314F. This Ducted Rocket Motor program is the only effort within the Department of Defense to develop and test this propulsion concept. There are other ramjet technology efforts, such as the Navy Advanced Low Volume Ramjet demonstration motor and the Air Force Advanced Strategic Air Launched Missile demonstration for missiles in the 2000 pound class. Exploratory development of solid fuel ramjet concepts have been initiated by the Services. All efforts are fully coordinated to avoid duplication through the Joint Army, Navy, NASA, Air Force Ramjet Subcommittee.

(U) WORK PERFORMED BY: The Air Force Aero Propulsion Laboratory, Wright-Patterson Air Force Base, Ohio will manage Ducted Rocket Motor project. Hughes Aircraft Company, Canoga Park, California is the contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable
2. (U) FY 1981 Program: Ducted Rocket Motor development work accomplished in Program Element 63302F will be expanded and the preparation of a flight test vehicle will continue. During this period, fixed fuel flow ducted rocket direct connect testing will be completed. Inlet aerodynamic testing, wind tunnel testing of the flight vehicle model, and safe separation tests in the wind tunnel will be accomplished. Development and fabrication of the flight test hardware will continue and flight test preparation will be started.
3. (U) FY 1982 Planned Program: Free jet testing of the ducted rocket engine and development of a nozzleless booster will be completed. Fabrication of flight test hardware will be finished and flight qualification actions will be accomplished. Assembly of the six flight test vehicles will be initiated. The final flight test plan will be issued. The difference from previous FY 1982 planned program is the delay of the Passive/Active Radar Seeker project.
4. (U) FY 1983 Planned Program: The flight demonstration will include six test flights over a wide range of likely employment conditions.

DDP Mission Area: Counter Air, #221

Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: The fixed fuel flow Ducted Rocket Motor project will be completed early in 1984. Flight tests with a variable fuel flow concept are scheduled to begin in 1985. Flight demonstration of an advanced air-to-air missile seeker concept is planned to begin in 1984.

6. (U) Milestones: Not Applicable.

7. (11) Resources:

RT&T:

3. (U) Comparison with FY 1981 Budget Data:

39108

<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Estimated</u>
<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Costs</u>
	3,300	6,000	7,000	23,000	39,300
	6,500	9,200		Continuing	Not Applicable

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63612

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63370F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT 1/	27,000	24,200	1,300	- 2/		80,200 3/
2437	Advanced Medium Range Air-to-Air Missile (AMRAAM)	27,000	24,200	1,300	-		80,200

1/ Funding shown is Air Force portion of Joint Air Force/Navy Validation Phase program. Navy share of Validation Phase program is \$74.7M and funded under Program Element 63370N.

2/ Program transitions to full scale development (Program Element 64314F) in fiscal year 1982.

3/ Total includes \$4.8 million in fiscal year 1977 and \$6.7 million in fiscal year 1978 in Program Element 63316F. Total does not include the Navy share of validation program, \$18.9 million in this Program Element in fiscal year 1978 for AIM-7 Advanced Monopulse Seeker, \$2.0 million in this Program Element in fiscal year 1979 for Ducted Rocket Motor (Ducted Rocket Motor removed from this Program Element in 1980 and beyond), and Full Scale Development funding.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This joint Air Force/Navy program is structured in response to the Joint Service Operational Requirement and Mission Element Need Statement to develop an AIM-7/Sparrow follow-on air superiority air-to-air missile with significant improvements in operational utility and combat effectiveness. A North Atlantic Treaty Organization Staff Target titled "Operational Objective for North Atlantic Treaty Organization Air-to-Air Missiles for the 1980s and Beyond," has identified a similar requirement. The need described is for an adverse weather, all aspect beyond visual range air-to-air missile compatible with the F-14, F-15, F-16, F-18 and appropriate North Atlantic Treaty Organization air superiority and air defense aircraft. The missile must have a performance envelope significantly improved over the AIM-7F/M, increased missile velocity, a "launch and maneuver" employment capability, and the capacity for multiple target attack during a single intercept. AMRAAM will satisfy these needs. Navy Advanced Medium Range Air-to-Air Missile validation funding is in Program Element 63370N while Full Scale Development funding is in Program Element 64314F.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funding for the completion of flight tests of the prototype Advanced Medium Range Air-to-Air Missiles fabricated by the two competing Advanced Medium Range Air-to-Air Missile contractors and preparations for Milestone II in November 1981. Full Scale Development will be initiated under Program Element 64314F. Cost estimate is based on in-house and independent cost estimates performed by/for the AMRAAM Joint System Program Office.

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Program Element: #63370F

DOD Mission Area: Counter, Air #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
RDTE	27,300	25,600	1,100			Costs
						82,100 1/ 2/

1/ Total Estimated Costs shown in the fiscal year 1981 Descriptive Summary was \$462.2 million which included Navy validation costs (\$74.7 million in Program Element 63370N) and Full Scale Development funding (\$305.4 million in Program Element 64314F) leaving \$82.1 million for Air Force Validation Phase funding.

2/ Includes fiscal year 1977 and fiscal year 1978 Validation Phase funding in Program Element 63316F.

(U) OTHER APPROPRIATION FUNDS: Not applicable. Procurement of the Advanced Medium Range Air-to-Air Missile under Program Element 27163F will be initiated in fiscal year 1984.

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Project: #2437

Program Element: #63370F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)

Title: Advanced Medium Range Air-to-Air Missile

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This joint Air Force/Navy program has the overall objective of continued improvement of United States and North Atlantic Treaty Organization air-to-air combat effectiveness. The Joint Air-to-Air Missile Requirements Study was initiated by the Under Secretary of Defense for Research and Engineering in October 1975. Combat deficiencies identified in South East Asia and the resultant improvements incorporated in the AIM-7F were reviewed to form the baseline for near and far term requirements definition. The study group reviewed the current and projected airborne threat spectrum, the Air Force/Navy roles and their relative priorities, and current technologies. The Joint Air-to-Air Missile Requirements Study findings were documented in a Joint Service Operational Requirement which was validated in September 1978. This Joint Service Operational Requirement and the Mission Element Need Statement, approved by the Secretary of Defense in January 1979, provide the basis for the Advanced Medium Range Air-to-Air Missile development effort. The threat spectrum for which the Advanced Medium Range Air-to-Air Missile is optimized includes: manned aircraft (fighters, bombers, fighter-bombers and interceptors) operating from _____ feet at speeds up to Mach _____ with maneuvering accelerations up to _____ and a majority of the _____ threat which operates at altitudes up to _____ feet and speeds up to Mach _____ The projected aircraft threat includes: improved capability for _____ avionics and _____ air-to-air missiles.

(U) In August 1980, the United States signed a Memorandum of Understanding with the United Kingdom, Germany and France concerning a Cooperative Program for a Family of Air-to-Air Missile Systems. The Memorandum of Understanding calls for the European participants to develop the next short range missile and the United States to develop the Advanced Medium Range Air-to-Air Missile to satisfy the medium range missile requirement in the North Atlantic Treaty Organization Staff Target.

(U) The Advanced Medium Range Air-to-Air Missile development effort has the objective of significantly increasing United States and North Atlantic Treaty Organization air-to-air capability and operational utility in the 1980s and beyond by producing a more effective, reliable, affordable, maintainable missile, with emphasis on low altitude targets in an electronic countermeasures environment. To satisfy the Mission Element Need Statement, Joint Service Operational Requirement, and North Atlantic Treaty Organization Staff Target, the proposed Advanced Medium Range Air-to-Air Missile design utilizes inertial mid-course guidance and an active radar terminal guidance approach. Key features which will improve operational utility include: high average missile velocity, more range than SPARROW, increased maneuverability, multiple target attack, and launch and leave capabilities. Mature technologies, such as solid state electronics, high rate digital computers, and terminal guidance-aided fuzing are featured in the contractor approaches. Of prime importance is the requirement for the Advanced Medium Range Air-to-Air Missile to be totally compatible with the fire/weapons control systems of the F-14, F-15, F-16, F-18 and appropriate North Atlantic Treaty Organization air superiority and air defense aircraft. The Validation Phase effort began in 1979 with the selection of two competitive contractor to fabricate and test components and then fabricate total prototype systems for live missile firings. Rail launchers will be developed to provide the necessary aircraft/missile interfaces and will be capable of Advanced Medium Range Air-to-Air Missile and SIDEWINDER carriage. Ejection launchers will be modified SPARROW launchers or new launchers developed for the Advanced Medium Range Air-to-Air Missile so as to maintain SPARROW launch capability.

Project: #2437

Program Element: #63370F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAM)

Title: Advanced Medium Range Air-to-Air Missile (AMRAM)

Budget Activity: Tactical Programs, #4

This Program Element has a parallel Navy Program Element (63370N) which contains approximately half the validation funds for this joint development of a common missile. Successful completion of this phase will allow an intensive Full Scale Development phase with first production deliveries in 1985.

(U) RELATED ACTIVITIES: The Advanced Medium Range Air-to-Air Missile development program is a Joint Service effort with the Air Force as Executive Service and Navy personnel integrated into the Joint System Program Office. The Navy has assigned to the Joint System Program Office the Deputy Program Manager, the Assistant Chief Engineer and various other assistants for logistics, budget, project management, and test. The Joint System Program Office is maintaining a close relationship with the F-14, F-15, F-16 and F-18 program offices to assure that proper consideration is given to the aircraft modifications that will be required. Other programs related to the full employment capability of the Advanced Medium Range Air-to-Air Missile include target identification and improved aircraft radar target processing techniques. In the Advanced Medium Range Air-to-Air Missile Decision Coordinating Paper issued after Milestone I, the Office of the Secretary Defense directed that an Operational Utility Evaluation be conducted concurrent with Validation and Full Scale Development. The Operational Utility Evaluation was to include simulation, analysis and flight tests necessary to establish the operational utility of the Advanced Medium Range Air-to-Air Missile as well as the cost and effectiveness benefits of the Advanced Medium Range Air-to-Air Missile compared to alternative systems. An Operational Utility Evaluation man-in-the-loop simulation and analysis effort is underway to establish the utility of the Advanced Medium Range Air-to-Air Missile by comparing the effectiveness of the Advanced Medium Range Air-to-Air Missile and AIM-7M with and without reliable identification systems and using single and multi-target track avionics in a realistic environment. Due to the avionics implications, the Operational Utility Evaluation was initiated under Program Element 64201F (Aircraft Avionics Equipment Development). However, with the addition of funds in fiscal year 1982 and fiscal year 1983 for expanding a range and procurement of long lead items to preserve an option to conduct an Operational Utility Evaluation flight simulation if one is required, the Operational Utility Evaluation effort exceeds the scope of Program Element 64201F. Beginning with fiscal year 1982, funding for the Operational Utility Evaluation and range upgrade is in Program Element 28008F, Operational Utility Evaluation of the Advanced Medium Range Air-to-Air Missile and Program Element 78019F, Utah Test and Training Range, respectively. Beginning in fiscal year 1982, the Advanced Medium Range Air-to-Air Missile Full Scale Development is funded under Program Element 64314F. Procurement of the Advanced Medium Range Missile will be funded under Program Element 27163F beginning in fiscal year 1984. Class V modification of the aircraft that will carry the missile will be funded under the aircraft weapon system program elements.

(U) WORK PERFORMED BY: The Advanced Medium Range Air-to-Air Missile development and acquisition program is being managed by the Advanced Medium Range Air-to-Air Missile Joint System Program Office at the Armament Division, Eglin Air Force Base, FL. In addition to the Armament Division, other government organizations/facilities participating in the development effort include White Sands Missile Range, NM; Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH; Air Force Materials Laboratory, Wright-Patterson Air Force Base, OH; Pacific Missile Test Center, Naval Air Station Pt Mugu, CA; and Naval Weapons Center, China Lake, CA. The two competing Validation Phase contractors are Hughes Aircraft Company, Canoga Park, CA and Raytheon Company, Bedford, MA.

Project: #2437

Program Element: #63370F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: During the first quarter of fiscal year 1977, the Advanced Medium Range Air-to-Air Missile design definition was initiated based upon the Joint Service Operational Requirement as directed by the Under Secretary of Defense for Research and Engineering with funding provided by Congress. Design efforts included performance optimization, cost trade-offs, the beginning of laboratory testing and scintillation/miss distance reduction demonstrations at the White Sands Missile Range facilities. Design proposals were prepared in anticipation of the beginning of the Validation Phase in fiscal year 1978. However, the fiscal year 1978 budget did not include funding for the initiation of the Validation Phase. In July 1978 Congress approved a reprogramming request of \$7.0 million from the Air Force and \$6.0 million from the Navy for a continuation of the competitive design definition effort that included component development and evaluation; system performance/cost/effectiveness evaluations; aircraft fire control/radar interface investigations; evaluation of the missile's capability in an electronic countermeasures and clustered target environment; and continued analysis of surface-to-air and long range applications of the Advanced Medium Range Air-to-Air Missile. Initiation of the Advanced Medium Range Air-to-Air Missile Validation Phase (Prototype) was approved at Milestone I in November 1978 and documented in the Advanced Medium Range Air-to-Air Missile Decision Coordinating Paper in January 1979. Thirty-three month Validation Phase contracts were awarded to Hughes Aircraft Company and Raytheon Company in February 1979. Primary efforts during fiscal year 1979 included missile subsystem and system level design, development and test; Advanced Medium Range Air-to-Air Missile launcher design and development; and initiation of the F-15 Class II modification. Design, development, and test continued through fiscal year 1980. Rail and ejection launchers were delivered, the Class II modification to the F-15 was completed and the F-16 Class II modification was nearing completion. Sixty-one captive carry seeker test missions were completed. Seekers from both contractors began testing in electronic countermeasures and clustered target environment in a detailed hardware-in-the-loop seeker simulation developed at the Army Missile Command, Huntsville, AL. Other simulations were also under preparation to evaluate the missile's flight performance.

2. (U) FY 1981 PROGRAM: Design, development, and fabrication of prototypes will continue. Extensive hardware-in-the-loop simulation testing will continue to evaluate the performance of each contractor's prototype missile. Class II modifications for the F-14 and F-16 will be completed in preparation for the prototype flight tests. The two competing Advanced Medium Range Air-to-Air Missile contractors will deliver prototype Advanced Medium Range Air-to-Air Missile controlled test vehicles and guided test vehicles for testing. The controlled test vehicles will be fired to demonstrate safe separation for the rail launched Advanced Medium Range Air-to-Air Missile. Subsequently, each contractor's guided prototypes will be fired under ten different launch conditions specified by the Government. Initial planning called for each contractor to deliver for test an additional six prototype Advanced Medium Range Air-to-Air Missiles to be fired under launch conditions specified by the contractors. Additional data that would have been collected during the contractor development flights will be collected during the more than 100 captive carry flights for each contractor. In lieu of these contractor development flights, each contractor will accomplish additional seeker development work and demonstrate the seeker that will be included in his Full Scale Development missile. Test data from all areas of evaluation will be compiled, reduced, and analyzed. Results will be formalized in support of presentations leading to Milestone II.

Project: #2437

Program Element: #63370F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

3. (U) FY 1982 PLANNED PROGRAM: Flight testing of the prototype AMRAAMs will be completed in early FY 1982. The results of the Validation Phase efforts will be presented at Milestone II in November 1981. The results of the prototype testing and the contractors' proposals for Full Scale Development (FSD) and initial procurement options will be evaluated to select one of the contractors to continue the development of AMRAAM. FSD will be initiated under Program Element (PE) 64314F. The \$200,000 increased funding in FY 1982 in PE 63370F is due to inflation.

4. (U) FY 1983 PLANNED PROGRAM: AMRAAM FSD will continue under PE 64314F.

5. PROGRAM TO COMPLETION: AMRAAM FSD will continue under PE 64314F. Extensive Development Test and Evaluation/Initial Operational Test and Evaluation will be conducted with Milestone III planned for FY 1985. Initial procurement funding for AMRAAM will be in FY 1984 under PE 27163F. First production delivery is planned for late FY 1985 with the initial operational capability for a planned for FY

6. (U) Milestones:

A. Start Design Definition	October 1976
B. Complete Design Definition	May 1977
C. Complete Pre-prototype Evaluations	July 1978
D. Complete Pre-prototype Evaluations	September 1978
E. Milestone I	November 1978
F. Award Validation Phase Contracts	February 1979
G. Subsystem Test Start	March 1979
H. Flight Tests Start	October 1980
I. Subsystem Test End	October 1981
J. Flight Tests End	October 1981
K. Milestone II	November 1981
L. Milestone III	March 1985
M. First Production Delivery	September 1985

7. (U) Resources: Not applicable

8. (U) Comparison with FY 1981 Budget Data: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63609P

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Advanced Attack Weapons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs	Not Applicable
<u>TOTAL FOR PROGRAM ELEMENT</u>								
2369	Wide Area Antiarmor Munitions	32,904	34,500	56,700	32,500	11,400	168,004	

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops and demonstrates prototype air-to-surface non-nuclear weapons. The total budget in FY 1982-1983 will be used to develop two Wide Area Antiarmor Munitions: the Wasp minimissile and the Extended Range Antiarmor Munition. These weapons are designed to meet the Tactical Air Forces' need to destroy multiple enemy tanks in a single aircraft pass under good or adverse weather conditions. The critical need for this capability against massed armor is documented in the approved Mission Element Need Statement for an Improve Wide Area Antiarmor Capability.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Major design, fabrication, and testing will be completed. Sixteen Wasp missiles will be fabricated and assembled for testing, and testing of critical subsystems such as the millimeter wave seeker will be completed. The Extended Range Antiarmor Munition will complete development and drop testing and will transition into full scale development following a Defense Systems Acquisition Review Council II program review. Contractor competition will be maintained on Wasp to reduce technical and cost risk. Cost estimates are based on current contractual obligations plus test activity estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

Project Number	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs	Not Applicable
RDT&E	34,800	25,100	56,300				

(U) OTHER APPROPRIATION FUNDS: Not applicable.

Project: #2369

Program Element: #63609F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Wide Area Antiarmor Munitions

Title: Advanced Attack Weapons

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The Mission Element Need Statement for an Improved Wide Area Antiarmor Capability details the critical need for the Tactical Air Forces to improve their armor kill capability against massed rear echelon armor. The Wide Area Antiarmor Munitions (WAAM) Program will improve the Tactical Air Forces' sortie effectiveness by increasing the number of armor kills per pass.

The need is to develop a weapon that will provide multiple kills per pass, during all hours and weather conditions and from extremely low altitudes or standoff distances. The ability to achieve multiple kills during a single pass will greatly improve the Tactical Air Forces' antiarmor capability while decreasing attrition to enemy defenses. WAAM has been designated a major program and will use multiple contractors to reduce cost/schedule risk in order to achieve an operational capability at the earliest possible time. Three weapon concepts -- the Antiarmor Cluster Munition, the Wasp Min missile, and the Extended Range Antiarmor Munition -- will be validated in this program. The Antiarmor Cluster Munition is an unguided improved antiarmor area cluster bomb that may be delivered at minimum altitudes or higher. The Antiarmor Cluster Munition submunition could also be packaged in a standoff delivered dispenser. The Wasp is a missile that employs a terminal seeker and a lock-on-after-launch guidance mode. The Wasp is intended for delivery from aircraft-mounted pods for minimum altitude attack. The Extended Range Antiarmor Munition is an air-delivered cluster weapon containing target-activated land mines that provide a standoff kill capability against armor. The target does not have to contact the Extended Range Antiarmor Munition submunition to effect a kill; rather the mine's sensor classifies the target, determines the closest point of approach, and then fires a warhead at the target.

(U) RELATED ACTIVITIES: WAAM technology support is ongoing in Program Element 62602F, Conventional Munitions, and Program Element 63601F, Conventional Weapons Technology. Warhead, sensor, seeker, and dispenser technology programs in these Program Elements provide the basis for the WAAM concepts. Other related Air Force programs (PAVE MOVER, F-16, A-10, and Assault Breaker) will be integrated with WAAM to provide a total wide area antiarmor system capability.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Additional contractor support is provided by Boeing Aerospace Company, Seattle, WA; Honeywell Incorporated, Minneapolis, MN; AVCO Corporation, Wilmington MA; and Hughes Aircraft Company, Conoga Park, CA.

(U) PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. (U) FY 1980 & Prior Accomplishments: Project 2369, Wide Area Antiarmor Munitions - Concept Definition studies initiated in FY 1977 were completed by multiple contractors on four WAAM concepts. Two competitive validation contracts for the Antiarmor Cluster Munitions were awarded in late FY 1978. Two contracts for the competitive validation of the

Project: #2369

Program Element: #63609F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Wide Area Antiarmor Munitions

Title: Advanced Attack Weapons

Budget Activity: Tactical Programs, #4

Extended Range Antiarmor Mine were awarded in June 1979. The Cyclops concept was eliminated in January 1979 to enable the program to live within funding constraints. Two validation contracts were awarded for the Wasp minimissile in November 1979 to accomplish system design, component fabrication, and testing of seekers and airframes. The final phase of Antiarmor Cluster Munition validation was successfully completed in FY 1980 with system development and validation tests. Following a favorable Milestone II decision in July, Antiarmor Cluster Munition advanced into Program Element 64607F, Wide Area Antiarmor Munitions for full scale development. Validation efforts for the other two concepts continued. The Extended Range Antiarmor Munition completed its preliminary design phase and began initial fabrication and testing of the classifier, sensor, and warhead.

2. (U) FY 1981 Planned Program: Funding for Wide Area Antiarmor Munitions was increased in FY 1981 by Congress. Program is restructured accordingly, with the Wasp minimissile validation reduced by nine months, completing in 1983. The shorter schedule results in decreased "To Completion" and "Total Estimated Costs." Advanced Conventional Standoff Missile funds have now been programmed to the Joint Navy/Air Force Medium Range Air-to-Surface Missile project. The Antiarmor Cluster Munition will continue in Full Scale Development, in Program Element 64607F, with fabrication of test items and start of Development Test and Evaluation. Validation efforts for the other two concepts will continue this year. Wasp will complete critical subsystem (seeker, guidance and control package) demonstrations. The Extended Range Antiarmor Munition will complete critical development and testing of the classifier, sensor and warhead and will complete the major part of system integration and validation testing.
3. (U) FY 1982 Planned Program: Validation of Wasp will continue. Drop tests, pattern tests, and live tests of implaced sub-munitions will complete the Extended Range Antiarmor Munition concept validation phase. The Antiarmor Cluster Munition will complete Development Test and Evaluation and major elements of Initial Operational Test and Evaluation. Given a favorable Milestone II decision, the Extended Range Antiarmor Munition will advance in Mid FY 1982 into Program Element 64607F for full scale development.
4. (U) FY 1983 Planned Program: Wasp will complete validation in FY 1983. A Defense System Acquisition Review Council II will be convened to review the program for Full Scale Development decision. This will complete the Wide Area Antiarmor Munitions effort in this Program Element.
5. (U) Program to Completion: Not Applicable
6. (U) Milestones:
 - A. Antiarmor Cluster Munition Validation Contract Award August 1978
 - B. Extended Range Antiarmor Munition Validation Contract Award June 1979
 - C. Wide Area Antiarmor Munitions Milestone 0 September 1979
 - D. Wasp Validation Contract Award November 1979

Project: #2369

Program Element: #63609F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Wide Area Antiarmor Munitions

Title: Advanced Attack Weapons

Budget Activity: Tactical Programs, #4

- E. Antiarmor Cluster Munition Milestone II (May 1980)*
(Full Scale Development Decision) Review
F. Extended Range Antiarmor Munition Milestone II Review April 1982
G. Wasp Milestone II Review (FY 1984)** FY 1983

* Date presented in FY 1981 Descriptive Summary. Previous date did not allow for decision time at review levels.

** Wasp schedule acceleration made possible by Congressional increase in FY 1981 funding.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	32,904	34,500	56,700	32,500	11,400	168,004

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	34,800	24,600	54,300	41,600	171,300
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FY 1981 funding level reflects increase by Congress. Program is restructured accordingly. The funding increase allows an acceleration of Wasp minimissile development by 9 months. The shorter schedule results in a reduction in total program costs.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63714F Title: DoD Physical Security Equipment-Exterior (Adv Dev)
 DoD Mission Area: Land Combat Service Support, #216 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
		3,900	7,500	1,000	4,100	8,400	51,900

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development of the Department of Defense Base and Installation Security System, a standardized exterior physical security system, by accomplishing advanced development tasks in four functional areas: detection, command and control, imaging, and entry control. A Department of Defense need exists for a family of standardized modular equipment, integrable into system configurations to provide a level of security in consonance with the deployment mode, threat level, and sensitivity of the asset being protected.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request provides for continued advanced development of technologies and prototype equipment for the Total Base and Installation Security System capability. The technology base and prototypes developed for this program will be deployed in three modes: permanent, semi-permanent, and mobile. Primary emphasis will be placed on detection, command and control, and imaging subsystems. Cost estimate based on inputs from various government agencies performing these development efforts.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,900	7,500	7,300		15,100	62,100
Procurement (Other)(27596F/27314F)	29,594	17,562	58,481		Continuing	Not Applicable
<u>(U) OTHER APPROPRIATION FUNDS:</u>						
Procurement (Other)(27596F/27314F)	11,780	17,590	12,203	39,429	Continuing	Not Applicable

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Program Element: #63714F

DoD Mission Area: Land Combat Service Support, #216

Title: DoD Physical Security Equipment-Exterior (Adv Dev)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program responds to Secretary of Defense direction contained in Department of Defense Directive 3224.3, 1 December 1976, which designates the Air Force as executive agency for the development of standardized exterior physical security equipment and systems for protection of bases and installations. The Air Force established the Base and Installation Security System program to accomplish the necessary advanced and engineering development tasks in meeting the Department of Defense component requirements. A world-wide increase in the level of terrorist threat and a greater emphasis on security protection for mission-critical resources necessitate the development of a standardized system capability for use by all Defense agencies. Established goals within the Base and Installation Security System program are the Initial Base and Installation Security System and Total Base and Installation Security System with scheduled availability dates of December 1979 and January 1986 respectively. The completed Initial Base and Installation Security System provides Type C (production) specifications for equipment providing a medium level of security for small permanent locations and a partial system capability for selected resources deployed in a semipermanent mode. The Total Base and Installation Security System objectives are to provide a capability for high level security, against all threat levels, for resources in three deployment modes: permanent, semipermanent, and mobile. The objectives of this program are to provide a technology base, accomplish advanced development tasks, and develop prototype equipment for full-scale development and integration under Program Element 64715F, Department of Defense Physical Security Equipment-Exterior (Engineering Development). Development of a technology base and prototypes is being carried out in four functional areas: detection, command and control, imaging, and entry control. Maximum utilization is being made of technology and prototypes developed by other Services and commercial sources whenever feasible.

(U) RELATED ACTIVITIES: Full-scale development of equipment, subsystem/system integration and test, and type C (production) specification development is accomplished under Program Element 64715F, Department of Defense Physical Security Equipment-Exterior (Engineering Development). Procurement of physical security equipment is accomplished using Other Procurement-Air Force funding under Program Element 27596F, Air Base Defense System. The Base and Installation Security System equipment will be designed for interoperability with the Army interior security system (Facility Intrusion Detection System) and the Army tactical sensor system (Remotely Monitored Battlefield Sensor System). This program also interfaces with an exploratory development program for nuclear site security managed by the Defense Nuclear Agency. Management oversight of the physical security equipment programs is provided by the Department of Defense Physical Security Equipment Action Group with the Chairperson residing in the Office of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: This program is managed by the Physical Security Systems Directorate, Electronic Systems Division, Hanscom Air Force Base, MA. Department of Defense agencies performing development tasks are: Rome Air Development Center, Griffiss Air Force Base, NY; Army Mobility Equipment Research and Development Command and Army Night Vision Laboratory, Fort Belvoir, VA; Army Waterways Experimental Station, Vicksburg, MS; Naval Avionics Center, Indianapolis, IN; Naval Ocean Systems Center, San Diego, CA; and the Naval Coastal Systems Center, Panama City, FL. In addition to these Defense agencies, the Department of Energy/Sandia Laboratories, Albuquerque, NM, performs advanced development tasks and the Analytical Systems Engineering Corporation assists in the system engineering support and integration task.

Program Element #63714F

DoD Mission Area: Land Combat Service Support, #216

Title: DoD Physical Security Equipment-Exterior (Adv Dev)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Although there are many advanced development tasks which have been accomplished towards the Initial Base and Installation Security System capability, the following are examples of major sub-system components which have completed advanced development: small permanent communications and display segment, open ramp boundary sensor, magnetic/seismic line sensor processor, transducer sensitivity tester, entry control identifier segment, ported coaxial cable sensor, and mobile individual resource protection sensor.
2. (U) FY 1981 PROGRAM: Advanced development continues in the following areas: pyroelectric vidicon imaging sensor, advanced fence sensor, advanced central data control/processing segment, sensor data acquisition, infrared charge coupled device fence sensor, and foliage penetration radar.
3. (U) FY 1982 PLANNED PROGRAM: The program consists of continued advanced development in support of the Total Base and Installation Security System. Primary emphasis will be placed on the advanced fence sensor, the advanced central data control and processing segment, sensor data acquisition, pyroelectric vidicon imaging sensor, and infrared charge coupled device fence sensor. The pyroelectric vidicon and infrared charge coupled device are expected to complete advanced development in Fiscal Year 1982. The decrease in the Fiscal Year 1982 research and development funding level is due to the termination of two activities: the waterborne intrusion detection segment and the installation security radar. Termination was effected due to the lack of firm user requirements and the increasingly high cost of these research and development efforts. The decrease in the Fiscal Year 1982 procurement funding level is due to the delay in procurement of entry control equipment and magnetic/seismic line sensor processor.
4. (U) FY 1983 PLANNED PROGRAM: The program consists of continued advanced development in support of the Total Base and Installation Security System. Primary emphasis will be placed on the foliage penetration radar, sensor data acquisition, and advanced sensor signal processing techniques. The advanced fence sensor is expected to complete advanced development in Fiscal Year 1983.
5. (U) PROGRAM TO COMPLETION: This program will provide technology and prototype equipment for engineering development of the Base and Installation Security System. Advanced development tasks will continue at a nominal level subsequent to the availability of the Total Base and Installation Security System capability to keep the system current with the state-of-the-art technology. The decrease in the total estimated research and development costs is due to the termination of two activities: the waterborne intrusion detection segment and the installation security radar. Termination was effected due to the lack of firm user requirements and the increasingly high cost of these research and development efforts.

6. (U) MILESTONES: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63718P Title: Electronic Warfare Technology
 DOD Mission Area: Electronic Warfare and Counter C³, #257 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,405	14,400	12,000	22,000	Continuing	Not Applicable
691X	Electronic Warfare Technology	8,205	11,000	9,000	15,000	Continuing	Not Applicable
2432	Warning and Power Management Systems Technology	2,200	3,400	3,000	7,000	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides advanced development in the area of electronic warfare where an expanded technology base is needed to solve critical penetration aid problems for all classes of manned and unmanned aircraft. This program also provides for component, technique and subsystem development leading to the reduction of acquisition and life cycle cost of electronic warfare equipment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Efforts in FY 1982 will address existing and predicted shortfalls in countering Soviet air defenses by demonstrating aircraft radar signature reduction concepts and confusing sophisticated threat radars. The largest new effort will begin a joint Air Force/Navy development of next generation threat warning system for the 1990's and improvements to existing radar warning receivers. Efforts started in previous years to counter air defense communication systems, counter threat missile guidance and investigating improved jamming power management concepts will continue. The cost estimate is based upon the number of different critical development areas, risk of these areas, and previous experience.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,000	14,400	19,700		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63718F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Electronic Warfare Technology

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Modern air warfare is dominated by the presence of a myriad of electronic devices that locate, monitor, guide and control offensive and defensive elements. Denial of enemy use of these devices while retaining the capability for our own systems is the function of electronic warfare. The survivability of our aircrews and the number of weapons delivered to the target are directly relatable to the efficiency of our electronic warfare systems. It is axiomatic that an enemy faced with a strong electronic warfare capability will attempt to enhance his capability through changes in tactics and improved equipment. To gain and maintain an advantage requires a strong electronic warfare technology program to provide demonstrated alternatives that counter any initiatives made by the enemy defense.

(U) The program consists of two projects. Project 2432 funds development of warning receivers used to alert aircrews of impending attack and also automatically set jammers against highest priority threats. In addition, an integrated receiver/jamming power management system is being developed to demonstrate jammer concepts against sophisticated threat environments. Project 691X funds development of radar, communication, navigation aid, and radar guided missile countermeasures. This includes both active jamming techniques (onboard or expendable) and passive techniques such as radar signature reduction, electronic intelligence receivers, and dispensed radar reflecting clouds called chaff used to confuse enemy radars.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with the Program Element (PE) 63743F, Electro Optical Warfare, and other electro-optical and Electronic Warfare programs as well as the advanced development work in similar activities by the Army and the Navy through joint reviews conducted by the Joint Technical Coordinating Group and memoranda of agreement. Exploratory development efforts are phased into this program from PE 62204F, Aerospace Avionics. Completed electronic warfare efforts are transitioned into the engineering development programs; PE 27252F, EF-111A; PE 64710F, Reconnaissance Equipment; PE 64724F, Tactical C³ Countermeasures; PE 64738F, Protective Systems; PE 64737F Airborne Self Protection Jammer; and PE 64739F, Tactical Protective Systems. Tri-Service efforts are in radar warning receivers and jamming systems and radar countermeasures. Joint Air Force/Navy efforts are in an Advanced Transmitter applicable to the ALQ-99 installed in the EF-111A and EA-68, countermeasures, and the New Threat Warning System.

WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the program. The major contractors are: Calspan Corporation, Buffalo, NY - study and analysis; Kuras-Alterman Corporation, Fairfield, NJ - jammer control and modulation techniques; SEDCO Corporation, Farmingdale, NY - antenna techniques; GTE Sylvia Corporation, Mountain View, CA - communications jammers; Georgia Institute of Technology, Atlanta, GA - electronic warfare technique analysis; Norden, Norwalk, CT - jammer techniques; Motorola, Phoenix, AZ - radar signal receivers and early warning radar ECM; Raytheon, Goleta, CA - jamming; Northrop, Chicago, IL - common transmitter chains; Sperry, Clearwater, FL - radio frequency sources, Westinghouse, Baltimore, MD - radar signal processors; and IBM, Owego, NY - signal processing software.

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Program Element: #63718F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Electronic Warfare Technology

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Recent accomplishments include demonstration and transition of:

to the program, countermeasures to engineering development, and new receiver technology to be used to update operational radar warning receivers, and an improved chaff cartridge now under joint US/Dutch engineering development (RR-180).

2. FY 1981 Program: New starts in FY 1981 include a missile fuze jammer to dud or predetonate threat missiles, a Joint Air Force/Navy development of additional methods to disrupt enemy air defense communications to protect penetrating aircraft, a joint service jammed weapons, new receiver concepts to reduce size and cost of advanced radar signal receivers, and advanced signal processors and antenna systems to handle dense and exotic signal environments expected in the late 1980's. To be continued in FY 1981 are: a new threat warning system study to identify requirements for new radar signal receivers, the joint Navy/Air Force expendable radio frequency decoy to counter threats, performance improvements to the advanced power management system, development of a jamming system, flight test of the radar countermeasure, and sure arrays for jamming pods. Scheduled for completion are the joint service warning system demonstrations of standardized jamming transmitters to reduce costs, a system to confuse enemy early warning defenses, and a demonstration of a frequency coverage and effectiveness of the EF-111A.

3. FY 1982 Planned Program: New starts are planned to apply advanced technology to critical survivability needs. These include: radar signature reduction concepts for advanced aircraft to improve survivability and reduce complexity of future electronic self protection systems, aerodynamic shaped chaff decoy to counter demonstration of a tactical

special receivers to identify characteristics and

radar emissions which cannot be recognized or countered by conventional jammers, and a Joint Air Force/Navy development of a next generation threat warning system for the 1990s and technology improvements to existing radar receivers to improve their performance. Continued efforts are a missile fuze jammer, jamming transmitters, the expendable decoy to counter advanced countermeasures, the

radar threats, and demonstration of advanced jamming power management concepts. Scheduled for completion are radar counter for strategic aircraft and demonstration and transition of demonstration of the countermeasures for jamming pods like the ALQ-131 or possibly the Advanced Self Protection Jammer.

Funding was reduced in FY 1982 in order to fund high priority readiness issues and because several radar countermeasure alternatives were transferred to the HAVE EXIT program for accelerated development. Several efforts were delayed or cancelled including technology improvement to the Wild Weasel system.

Program Element: #63718F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Electronic Warfare Technology
Budget Activity: Tactical Programs, #4

4. FY 1983 Planned Program: The FY 1983 program will accelerate development of critical capability shortfalls by developing more generic expendable decoys and onboard countermeasures able to counter a wider array of threats or threat changes, new technologies to reduce the growing size, complexity, maintainability, and cost of electronic warfare systems. Radar signature reduction, improved doppler chaff, countermeasures alternatives, radar, and exotic radar signal recognition receivers, and the New Threat Warning System will continue. The threat missile fuze jammer, and the joint Air Force/Navy countermeasure expendable decoy will complete flight testing and be ready for transition.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

Project: 691X

Program Element: #63718F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Electronic Warfare Technology

Title: Electronic Warfare Technology

Budget Activity: Tactical Programs, # 4

(U) DETAILED BACKGROUND AND DESCRIPTION: The enemy air defense network is characterized by both airborne and land based radar and communication systems that locate, monitor, guide, and control offensive and defensive elements. The enemy continues to improve these elements against our forces and our operational countermeasures. This requires a strong technology base to provide demonstrated counters to these improvements and avoid technological surprises by new enemy threat systems.

(U) Project 691X was established to provide advanced development of new countermeasure techniques and hardware for both existing and new electronic warfare systems. The project includes the following areas: (1) a supporting simulation effort that guides the allocation of funding through the evaluation of new concepts and techniques; (2) radar signature reduction to delay and impair acquisition and tracking of our aircraft by enemy radar; (3) on-board jamming systems, components and techniques needed to jam enemy radar; (4) offboard or expendable systems to confuse enemy radars and dilute enemy defenses; (5) tactic and electronic collection systems to inform the field commander of changes in the electronic environment; and (6) the development of standardized and low cost components and systems to enable the Department of Defense to better afford the increasing amount and sophistication electronic countermeasures equipment required on modern aircraft.

RELATED ACTIVITIES: The efforts in this program are closely coordinated with the Program Element 63743F, Electro-Optical Warfare, and other electro-optical and EW programs as well as the advanced development work in similar areas conducted by the Army and the Navy. Exploratory development efforts are phased into this program from PE 62204F, Aerospace Avionics. Completed EW efforts are transitioned into the engineering development programs; PE 27252F, EF-111A; PE 64710F, Reconnaissance Equipment; PE 64724F, Tactical C3 Countermeasures; PE 64738F, Protective Systems; PE 64737F, Advanced Self Protection Jammer; and PE 64739F, Tactical Protective Systems. Tri-Service efforts are in radar warning receivers and jamming systems and efforts are in an Advanced Transmitter applicable to the ALQ-99 installed in the EF-111A and EA-6B, and countermeasures, and the New Threat Warning System.

WORK PERFORMED BY: The Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH, manages the program. The major contractors are: Calspan Corporation, Buffalo, NY - study and analysis; SEDCO Corporation, Farmingdale, NY - antenna techniques; GTE Sylvania Corporation, Mountain View, CA - communication jammers; Georgia Institute of Technology, Atlanta, GA - electronic warfare technique analysis; Norden, Norwalk, CT - jammer techniques; Motorola, Phoenix, AZ - radar signal receivers and early warning radar ECM; Raytheon, Goleta, CA - jamming; and Northrop, Chicago, IL - common transmitter chains.

Project: 69IX

Program Element: #63718F

DOD Mission Area: Electronic Warfare and Counter C3, #257

Title: Electronic Warfare Technology

Title: Electronic Warfare Technology

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Recent accomplishments include demonstration and transition of:

radar countermeasures to engineering development, and new receiver technology to be used to update operational radar warning receivers, and an improved chaff cartridge now under joint US/Dutch engineering development (RR-180).

2. FY 1981 Program: New starts in FY 1981 include a missile fuze jammer to dud or predetonate threat missiles, a joint Air Force/Navy development of additional methods to disrupt enemy air defense communications to protect penetrating aircraft, and a joint service broad-band jammer transmitter to counter projected weapons. To be continued in FY 1981 are: a joint Navy/Air Force expendable radio frequency decoy to counter countermeasures, development of a radar countermeasure, and countermeasure arrays for system, flight test of the jamming pods. Scheduled for completion are the joint service warning system jamming pods. Demonstrations of standardized jamming transmitters to reduce costs, a system to confuse enemy early warning defenses, and a demonstration of a countermeasure to increase the frequency coverage and effectiveness of the EF-111A.

3. FY 1982 Planned Program: New starts are planned to apply advanced technology to critical survivability needs. These include: radar signature reduction concepts for advanced aircraft to improve survivability and reduce complexity of future electronic self protection systems, aerodynamic shaped chaff decoy to counter demonstration of a tactical jammer and special receivers to identify characteristics and radar emissions which cannot be recognized or countered by conventional jammers. Continued efforts are a missile fuze jammer, countermeasures, the broadband jamming transmitters, and the expendable decoy to counter advanced radar threats. Scheduled for completion are demonstration of the radar counter for strategic aircraft and demonstration and transition of countermeasures for jamming pods like the ALQ-131 or possibly the Advanced Self Protection Jammer. Funding was reduced in FY 1982 in order to fund high priority readiness issues and because several countermeasure alternatives were transferred to the HAVE EXIT program for accelerated development. Several efforts were delayed or cancelled including technology improvement to the Wild Weasel system.

Project: 691X

Program Element: #63718F

Title: Electronic Warfare Technology
Title: Electronic Warfare Technology
DOD Mission Area: Electronic Warfare and Counter C³, #257
Budget Activity: Tactical Programs, #4

4. FY 1983 Planned Program: The FY 1983 program will accelerate development of critical capability shortfalls by developing more generic expendable decoys and onboard countermeasures able to counter a wider array of threats or threat changes, new technologies to reduce the growing size, complexity, maintainability, and cost of electronic warfare systems. Radar signature reduction, improved doppler chaff, countermeasures alternatives, and radar will continue. The threat missile fuze jammer, and the joint Air Force/Navy countermeasure expendable decoy will complete flight testing and be ready for transition.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources: (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
691X	Electronic Warfare Technology	8,200	11,000	9,000		Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RD&E							
Project 691X	7,800	11,200	14,800		Continuing		Not Applicable

FY 1982: Funding in FY 1982 represents a \$5,800 thousand decrease in order to fund higher priority Air Force requirements. The impact of this decrease will delay technology efforts in areas where either the anticipated technology or the requirement has not fully matured. In addition, several countermeasure efforts were transferred to the HAVE EXIT program for accelerated development.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63727F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Technology
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT								
2345	Airborne Imagery Transmission	3,460	0	3,400	3,400	Continuing	Not Applicable	Not Applicable
2746	Low Probability of Intercept Communication			500	1,500	Continuing	Not Applicable	Not Applicable
2747	Communication Vulnerability Analysis			1,000	1,000	Continuing	Not Applicable	Not Applicable
2748	Advanced High Frequency Technology			500	500	Continuing	Not Applicable	Not Applicable
2538	Integrated Communication Navigation		590					
	Identification Avionics*							
	* Transferred to PE 63253F, Advanced System Integration Demonstration							

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Modern military systems and weapons derive much of their value from the communication systems which provide the primary means of force coordination and battle management. The Soviet Radio Electronic Combat doctrine states that

This program provides continuing research and development of new communication technologies to offset this threat evolution and to insure viable communications during the 1980s and 1990s.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Air Force is required to perform tactical operations in an increasingly complex electronic countermeasures (ECM) environment. To insure that data links will function in the presence of ECM, an advanced development of a modular wideband jam-resistant reconnaissance data link will be started. A systems analysis and concept exploration of low probability of intercept communication will begin. A center of expertise for communication vulnerability analysis will be established. An effort to define the scope of a communication vulnerabilities and define analysis and testing methodologies will be started with the Navy. A technology program to improve long-range communication in an environment of hostile electronic warfare activities and adverse channel perturbations (multi-path, fading, doppler) will be started.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E								
		3,700	4,200	5,200		Continuing	Not Applicable	

Program Element: #63727F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Technology

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Modern military systems and weapons derive much of their value from communication systems, which provide the primary means of force coordination and battle management. The Soviet Radio Electronic Combat doctrine states that

This program provides continuing research and development of new ECCM communication technologies to offset this threat evolution. Various Air Force ECCM programs have established "Red Teams" to analyze possible design vulnerability and assist with test program definition. The Air Force needs to consolidate this expertise and develop a comprehensive methodology for vulnerabilities analysis and testing.

At the same time, the US is developing and deploying many new reconnaissance platforms and weapons requiring data links. This program will develop a new advanced jam resistant reconnaissance data link. The Air Force must continue to address intercept-analysis and physical survivability. Low Probability of Intercept (LPI) communications are required to reduce the vulnerability of C3I systems to anti-radiation weapons and communication location analysis (electronic templating). The Air Force continues to improve world wide communications through the use of satellite communication (SATCOMS) systems. The Air Force requires alternative communication systems to SATCOM for improved survivability.

(U) The Jam Resistant Data Link Transmission project is developing and applying technologies to protect future data links from jamming, this project is part of the Joint Service Weapon Data Link (JSWDL) program; as such this advanced technology will be available for use by other Services via close coordination of developments. The Low Probability of Intercept (LPI) project will develop and apply LPI technologies to increase the survivability of tactical C3 systems. The Communication Vulnerability project will develop and apply technologies and methodologies to analyze and test jam-resistant and LPI communication systems.

Project Number:

2345

Airborne Imagery Transmission: This program will provide the advanced data link technology required to counter the Soviet threat during the late 1980s and after.

program emphasis will be

Program Element: #63727F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Technology
Budget Activity: Tactical Programs, #4

extremely wide band spread spectrum modems. The modular concept will be extended to tactical reconnaissance data link requirements. An advanced technology data link will be developed and demonstrated to provide a jam-resistant, covert, tactical reconnaissance, data link.

2746

(U) Low Probability of Intercept (LPI) Communication: In conjunction with Air Force Exploratory Development, research, analyze, define and scope the susceptibility of tactical command, control, communication and intelligence to intercept-analysis and anti-radiation weapons in the 1990s time frame. Develop and demonstrate jam-resistant, LPI communication technology leading to a packetized, burst signal waveforms for tactical communication systems.

2747

(U) Communication Vulnerability Analysis: Establish a technical center of expertise for the analysis and assessment of communication electronic counter-countermeasures (ECCM) and low probability of intercept system vulnerabilities. Assist Program Offices developing communication systems establish and define Red Team threat and system test assessments. Provide analysis and guidance to the Air Force on electronic counter-countermeasures, low probability of intercept and hybrid communication techniques. Develop special test equipment to exploit ECCM communications. Provide technical analysis of foreign ECCM communications.

2748

(U) Advanced High Frequency Technology: Plan for the development of jam-resistant, wide band HF technology. This technology will provide alternative voice and data capability in a jamming and nuclear environment.

(U) RELATED ACTIVITIES: This program is part of a coordinated effort to improve communication capabilities. As such it is related to Command, Control and Communications, PE 62702F; Command, Control and Communication Advanced Development, PE 63789F; and Advanced Communication Systems; PE 27423F. Advanced data link technology efforts will develop an advanced, wide band jam-resistant data link for real and near-real time reconnaissance efforts in Electronic and Physical Sciences, PE 63208F; and Tactical Surveillance, Reconnaissance, and Target Acquisition, PE 64710F. Data link development tasks are coordinated with the Army Modular Integrated Communication, Navigation System, PE 64748A.

(U) WORK PERFORMED BY: Air Force Systems Command (AFSC), Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson AFB, OH. Contractors include: TRW Defense and Space, Redondo, CA; General Dynamics Electronic Division, San Diego, CA; ITT Avionics Division, Nutley, NJ; GTE Sylvania, Needham, MA; Electromagnetic Compatibility Analysis Center, Annapolis, MD; General Electric Company, Urica, NY; Motorola Inc., Scottsdale, AZ; RCA Corporation, Camden, NJ; and AEL Inc., Lansdale, PA. Federal Contract Research Center support is being provided by MIT Lincoln Laboratories, Lexington, MA;

Program Element: #63727F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Technology

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The Joint Service Weapon Data Link Plan was developed. Efforts to design and develop an advanced jam-resistant weapon data link were started and preparations for flight testing began. An imagery compression test and evaluation facility was started. Image compression techniques were evaluated in conjunction with a spread spectrum modem. Efforts to develop advanced antenna nulling techniques for weapons, data link and imagery compression techniques were continued. Efforts to design technology were initiated.
2. (U) FY 1981 Program: (U) As the result of Congressional direction to discontinue weapon data link development supporting the GBU-15 and Precision Location Strike System (PLSS), data link development efforts were restructured to emphasize tactical reconnaissance applications of jam-resistant, electronic counter-countermeasures data links. New communication development projects were started as part of an overall Air Force review of future communication needs. Initial development of an optimal architecture for a Communication Navigation Identification (CNI) signal processor was started. This architecture will be used for design and fabrication of a signal processor using radio frequency large scale integration techniques. Integrated CNI algorithms and software will be concurrently developed.
3. FY 1982 Planned Program: Design of an advanced capability modular tactical reconnaissance data link will begin. This data link will provide jam-resistance to communications, provide reduced sensitivity to interception and reduced vulnerability to anti-radiation weapons. This data link development will support the Services real and near-real time reconnaissance system developments in Program Element 63208F, Electronic and Physical Sciences. Vulnerability analysis technology is being developed through other Air Force program. This technology will serve as a foundation for a program to consolidate Air Force efforts and provide a focal point for Joint Service efforts in vulnerability analysis. A center of expertise for communication vulnerability analysis will be established. The development of testing methodologies in conjunction with Air Force test agencies will begin. On-going vulnerability analysis effects in the Air Force, Army and Navy will be reviewed. An effort to define the scope of a communication vulnerabilities program, and to define analysis and testing methodologies will be started with the Navy. Development of a threat model to assess the vulnerability structure of tactical communications to intercept, location and physical destruction will be started. These studies will define a new communication system significantly less threat sensitive. This new system will combine low probability of intercept, jam-resistance and security. To insure that data links will function in the presence of ECM, an advanced development wideband spread spectrum modem development will be started to provide a very high degree of jam-resistance to reconnaissance system. A systems analysis and concept exploration of low probability of intercept (LPI) communication will be started. A technology program to improve long-range communications in an environment of hostile electronic warfare activities and adverse channel perturbations (multi-path, fading, doppler) will be started.

Program Element: #63727F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Technology
Budget Activity: Tactical Programs, #4

4. (U) FY 1983 Planned Program: Complete system concept designs of an advanced electronic counter-countermeasures (ECCM) data link for tactical reconnaissance systems. Begin initial equipment fabrication of this modular data link. Continue development of low probability of intercept (LPI) communication technology and communication vulnerability assessments. Initiate development of special test equipment and develop a test bed for evaluating ECCM and LPI communications.

5. Program to Completion: Continue development of a tactical reconnaissance data link with subsystem fabrication, integration and flight demonstration. Within the architecture defined for the modular tactical reconnaissance data link, modular technologies will be developed using reduced susceptibility to jamming, wide band video and digital data with an and multi-beam antenna system.

6. (U) MILESTONES: Not Applicable

663-664B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 63739P

Title: Advanced Drone/Remotely Piloted Vehicle
Budget Activity: Tactical Programs, #4

DOD Mission Area: Target Surveillance, Reconnaissance
and Target Acquisition, #255

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
2355	TOTAL FOR PROGRAM ELEMENT Special Projects/Mini-Remotely Piloted Vehicles	3,500 3,500	4,160 4,160	2,900 2,900	2,400 2,400	Continuing Continuing	Not Applicable Not Applicable	

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides for advanced development of systems and subsystems for Air Force drones and remotely piloted vehicles. The Tactical Air Forces have identified a need for low cost expendable drones for defense suppression including a requirement to investigate advanced sensor and seeker types to enhance and further exploit the mission capability of expendable drones. The Special Projects/Mini-Remotely Piloted Vehicles effort verifies the military applications of advanced subsystems including sensors/seekers to enhance the cost effectiveness and mission flexibility of mini-remotely piloted vehicles.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Advanced technology efforts which integrate various sensors/seekers in mini-remotely piloted vehicles and demonstrate low cost airframe and engine concepts will be continued. The principle efforts planned include flight test and concept evaluation of an anti-communications jammer seeker on a mini-remotely piloted vehicle, component evaluation of an electric powered propulsion system for use in mini-drones and other advanced sensor/seeker investigations. The cost estimates were derived by the Systems Program Office in June 1980 using analogy and Program Office adders based on experience.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	3,500	4,200	2,800		Continuing	Not Applicable	

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Project: #2355

Program Element: # 63739F

DOD Mission Area: Target Surveillance, Reconnaissance
and Target Acquisition, #255

Title: Special Projects/Mini-Remotely Related Vehicles

Title: Advanced Drone/Remotely Piloted Vehicle Development

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: A Joint Air Force/Defense Advanced Research Projects Agency/German Federal Ministry of Defense program began in 1975 to demonstrate a very low-cost expendable mini-remotely piloted vehicle equipped with an anti-radar seeker for defense suppression. This concept has matured into the LOCUST vehicle program and is planned to begin full scale engineering development in Program Element 64746F, Expendable Drones, as a Joint United States/Federal Republic of Germany development program.

(U) In addition to the emitter seeker used for the LOCUST vehicle demonstration, Defense Advanced Research Projects Agency expanded its investigation into advanced technology sensors/seekers for expanding and improving the mission capability of mini-drones. The objectives of Project 2355, Special Projects/Mini-Remotely Piloted Vehicles is to continue the efforts initiated by Defense Advanced Research Projects Agency by integrating and testing new sensors/seekers on mini-remotely piloted vehicles, demonstrating low-cost advanced launch concepts, and pursuing advanced mini-air vehicle and engine developments.

(U) RELATED ACTIVITIES: Advanced developments for United States Army mini-remotely piloted vehicles are accomplished in Program Element 63725A, Remotely Piloted Vehicles/Drones, and are directed toward future mini-remotely piloted vehicle reconnaissance and surveillance missions. The United States Air Force accomplishes remotely piloted vehicle engineering development in Project Element 64746F, Expendable Drones. Inter-service coordination in the remotely piloted vehicle area is accomplished through reviews by the Office of the Secretary of Defense, the Joint Technical Coordination Group for remotely piloted vehicles which emphasizes technological interchanges, and the Tactical Air Command/Training and Doctrine Command Coordinating Group which focuses on the operational aspects of remotely piloted vehicles. Advanced mini-remotely piloted vehicles sensor development initiated by Air Force/Defense Advanced Research Projects Agency will be continued in this project.

(U) WORK PERFORMED BY: The Aeronautical Systems Division at Wright-Patterson Air Force Base, OH, is responsible for efforts accomplished in this program element. Most of the testing is accomplished at the Hill-Wendover-Dugway Test Range, UT, and the Nellis Test Ranges, NV. Contractors participating in Special Projects/Mini-Remotely Piloted Vehicle tasks are: General Dynamics, Pomona, CA, and Developmental Sciences Incorporated, City of Industry, CA; E-Systems, Melpar Division, Arlington, VA; Lincoln Laboratory, Boston, MA; and The Analytic Sciences Corporation, Dayton OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Concept definition and design studies for an advanced multimission remotely piloted vehicle were completed in Project 2119, Advanced Remotely Piloted Vehicle Investigations in FY 1977. Project 2355, Special Projects/Mini-Remotely Piloted Vehicles, was started in FY 1977 to continue advanced sensor developments initiated by Defense Advanced Research Projects Agency to expand mission application and lower the cost of expendable mini-remotely piloted vehicle systems. Studies and tests were conducted on millimeter wave and acoustic sensors. These efforts indicated that the millimeter wave sensor possessed sufficient potential

Project: #2355

Program Element: # 63739F

DOD Mission Area: Target Surveillance, Reconnaissance
and Target Acquisition, #255

Title: Special Projects/Mini-Remotely Related Vehicles

Title: Advanced Drone/Remotely Piloted Vehicle Development

Budget Activity: Tactical Programs, #4

to warrant further investigation. In FY 1978, a millimeter wave seeker was integrated into a mini-remotely piloted vehicle and flight tested. A total of twelve flights were accomplished to demonstrate autonomous search, terminal dive, and pull-out on a target. Using the data generated from these tests, a follow-on effort was initiated in FY 1979 to upgrade the sensor, and optimize the software for continued validation testing. In FY 1979, a LOCUST vehicle live warhead demonstration to address Congressional system effectiveness concerns was successfully completed. A modulated laser program was completed in FY 1980 and demonstrated target detection/identification using a laser line scanner. A feasibility study was also completed in FY 1980 which identified an electric propulsion system as a viable alternative to a two-cycle gasoline engine for mini-drone applications.

2. (U) FY 1981 Program: Special Projects/Mini-Remotely Piloted Vehicle tasks will continue to include: flight test of the millimeter wave sensor; demonstration of mini-remotely piloted vehicle advanced airframe, engine and launch concepts; and investigation of advanced sensor and electronic warfare systems applicable to mini-remotely piloted vehicles. Hardware definition of advanced antennas/seekers/processors for mini-drone applications against enemy communications jammers.

3. FY 1982 Planned Program: Special Projects/Mini-Remotely Piloted Vehicle advanced development efforts will be continued. Millimeter wave sensor investigations will be expanded to include that show promise in increasing the mission capabilities of expendable mini-drones. Demonstrations/investigations of airframe, engine, advance sensor and launch concepts to include electric propulsion systems and anti-communication jammer seekers which could enhance and exploit the mission capabilities of mini-remotely piloted vehicles will be continued.

4. (U) FY 1983 Planned Program: Special Projects/Mini-Remotely Piloted Vehicle development efforts will be continued. An electric propulsion system will be integrated into a mini-drone and flight demonstrations initiated. Advanced seekers/sensors investigations will be continued to enhance and further exploit the mission capabilities of mini-remotely piloted vehicles.

5. (U) Program to Completion: This is a continuing program. Special Project/Mini-Remotely Piloted Vehicle level-of-effort advanced technology programs will be continued to enhance and expand mission capabilities of mini-remotely piloted vehicles.

6. (U) Milestones: Not Applicable.

Project: #2355

Program Element: # 63739F

DOD Mission Area: Target Surveillance, Reconnaissance

Title: Special Projects/Mini-Remotely Related Vehicles

Title: Advanced Drone/Remotely Piloted Vehicle Development

Budget Activity: Tactical Programs, #4

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>	
RDT&E	3,500	4,160	2,900	2,400	Continuing		Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	3,500	4,200	2,800	Continuing	Not Applicable
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(U) FY 1982: Funds reflect an increase of \$100 thousand due to a change in inflation indices.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63742F

Title: Tactical Identification Systems
Budget Activity: Tactical Programs, # 4

DOD Mission Area: Tactical Command and Control, #254

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate To Be	Total	
						Additional to Completion To Be	Estimated Costs To Be
TOTAL FOR PROGRAM ELEMENT							
		7,099*	2,750	14,800	Determined	Determined	Determined
1177	Non-cooperative Identification Techniques	1,100	2,750	3,300	To Be Determined	To Be Determined	To Be Determined
2599	Cooperative Identification Technology	5,999		11,500	To Be Determined	To Be Determined	To Be Determined

*Reflects recent reprogramming.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program element is to accomplish advanced development of technology that can be used to provide reliable long range identification of airborne targets in both all-weather and hostile electromagnetic countermeasure environments. This program is necessary because the numerical superiority of the projected threat demands that we be capable of engaging the enemy at long ranges with our beyond visual range weapons. The long range identification that is a prerequisite for such engagements

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to begin engineering simulation of hardware and software necessary to integrate and correlate identification data inputs from both non-cooperative and cooperative identification techniques. Also includes funding for fabrication of advanced development models of a cooperative (question and answer) identification system to replace the aging Mark XII identification system. Complementary technological approaches for obtaining identification information (i.e. cooperative, non-cooperative and the integration of the two) are necessary to assure a high confidence identification capability over the wide range of conditions existing in tactical warfare situations. Costing of these activities was based on parametric estimates performed by the Combat Identification System Program Office at the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH as of 7 January 1981.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Total	
					Additional to Completion	Estimated Costs
	5,100	14,700	10,200	Continuing	Not Applicable	

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63742F

DOD Mission Area: Tactical Command and Control, #254

Title: Tactical Identification Systems

Budget Activity: Tactical Program, #4

DETAILED BACKGROUND AND DESCRIPTION: Beyond visual range identification of airborne targets is

In March 1978, North Atlantic Treaty Organization (NATO) Long Term Defense Program Task Force Five on Air Defense

Similarly, the need for improved identification capability has been documented by Tactical Air Command Statements of Need 304-79 and 305-79 and most recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980.

This program element will fund advanced development of cooperative and non-cooperative identification techniques that can be applied to the problem. Both types of identification technology must be developed

Project 1177, Non-cooperative Identification Techniques is developing non-cooperative sensor techniques that will permit autonomous identification of hostile and friendly aircraft. Included in these techniques is the Dual Mode Recognition technique which identifies the aircraft

Identification, another technique under development, will use radio frequency emissions from target aircraft to perform long-range, adverse-weather air-to-air identification passively. Project 1177 is also developing the capability to integrate and correlate identification information from multiple sources onboard the weapon system to raise the confidence level and better manage the overall identification process. Project 2599, Cooperative Identification Technology is developing technology for a replacement system for the Mark XII Identification, Friend or Foe (IFF) System. Efforts will focus on advanced development of a NATO interoperable, secure and jam-resistant cooperative (question and answer) system for positive identification of friendly forces. Near term work is emphasizing the definition of United States requirements and the exploration of alternative solutions. This work is also the basis for developing the United States position in efforts to reach agreement with the other NATO nations on the signals-in-space and other interoperability characteristics of the next generation question and answer system(s). This work, in conjunction with related efforts of the Army and Navy, provides a balanced United States approach to the

in NATO.

(U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Advanced Identification Techniques; PE 63706A, IFF Developments; PE 64211N, AIMS/ATCRBS/Mark XII; PE 64709A, IFF Equipment; and PE 64725F, Aircraft Identification Systems. Coordination and integration of the various activities under these program elements is accomplished through the Combat Identification System Program for which the Air Force is lead service.

(U) WORK PERFORMED BY: The overall program is managed by the Combat Identification System Program Office at the Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson Air Force Base, OH. The Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright-Patterson Air Force Base, OH is managing Project 1177 for the Combat Identification System Program Office. Contractors supporting Project 1177 are: Westinghouse Corp., Baltimore, MD; Hughes Aircraft Co., Culver City, CA; McDonald Douglas Aircraft Corp., St. Louis, MO; Hazeltine Corp., Greelawn, NY; and General Dynamics Corp., Fort Worth, TX. Contractors providing support to Project 2599 include: Dynamics Research Corp., Wilmington, MA; Bendix Corp., Baltimore, MD; E-Systems, St. Petersburg, FL; and Hazeltine Corp., Greelawn, NY. Support is also provided by the Massachusetts Institute of Technology Lincoln Laboratory, Lexington, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD.

Program Element: #63742P

DOD Mission Area: Tactical Command and Control, #254

Title: Air-To-Air Identification

Budget Activity: Tactical Program, #4

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Day and day/night electro-optical identification devices have been developed and tested under this program element. These included the Laser Augmented Target Acquisition/Recognition System, the Laser Electro-Optical System and the Eagle Eye III which is an electro-optical identification sensor that is being considered for low-cost retrofit into the F-15. Additionally, the technology base for Dual Mode Recognition (DMR), an identification algorithm that processes target aircraft, was developed and tested. An effort to integrate and correlate identification information from multiple sources onboard fighter aircraft and thereby raise the overall confidence level of the identification process has been initiated. The potential onboard contributors of this information as well as various technical concepts for implementation have been identified. Multiple technology studies for the cooperative (question and answer) identification system were completed.
2. (U) FY 1981 Program: Flight tests will be initiated, using an available radio frequency sensor package, to demonstrate the feasibility of performing non-cooperative air-to-air identification passively. Also, complementary design trade studies of radio frequency emitter passive identification techniques will be conducted as will engineering simulation of the implementing identification algorithms. Similarly, the design of algorithms and display concepts to integrate identification information from multiple sensors will continue. Additionally, with fiscal year 1981 reprogramming, design trade offs and cost effectiveness studies of a NATO interoperable, cooperative (question and answer) identification system will be conducted. The results of these efforts will form the basis of United States efforts to reach agreement with NATO.
3. (U) FY 1982 Planned Program: Initiate engineering simulation of hardware and software necessary to integrate and correlate identification data inputs from both cooperative and non-cooperative identification techniques. The concept definition contracts for alternative design approaches to a cooperative (question and answer) identification system will be completed and fabrication of advanced development models of a cooperative (question and answer) identification system will begin. Engineering simulation of various identification algorithms will continue. Additionally, the feasibility of using a radio frequency sensor to perform non-cooperative, air-to-air identification passively will be demonstrated and design trade studies of various radio frequency, passive identification techniques will be completed as will the design of algorithms and display concepts to integrate identification information from multiple sensors. This Descriptive Summary differs from the FY 1981 Descriptive Summary in that the \$12 million requested for the cooperative (question and answer) identification system in FY 1981 was not provided because of Congressional concerns over the need for additional program planning and NATO agreement. As a result, FY 1980 funding was increased to specifically address the Congressional concerns, and the FY 1982 funding was increased to offset the schedule impacts of the FY 1981 reduction.
4. FY 1983 Planned Program: Engineering simulation of radio frequency emitter, passive identification algorithms will be completed. Non-cooperative target identifications techniques will be initiated. Also, identification data integration software and display for the F-15/F-16 will transition to engineering development via man-in-the-loop simulation/demonstration. In addition, testing of the advanced development models of the cooperative, (question and answer) identification system will be conducted.

Program Element: #63742F

DOD Mission Area: Tactical Command and Control, #254

Title: Tactical Identification Systems
Budget Activity: Tactical Program, #4

5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable

Project: #2599

Program Element: #63742F

DOD Mission Area: Tactical Command and Control, #254

Title: Cooperative Identification Technology
Title: Tactical Identification Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The principal method now used for target identification is a question and answer system which is the Mark X or Mark XII. The Mark XII system is a Mark X system with an added cryptographic computer to encipher the question and answer. This equipment is capable of identifying friends similarly equipped. The Mark X system is not secure (i.e., it can be read and spoofed) and is used by foes, friends and neutrals alike for air traffic control purposes. In 1955 the International Civil Aviation Organization provided a Mark X system to the Warsaw Pact for air traffic control standardization. As a result, the United States developed the Mark XII in 1958 to provide a secure identification capability. The Mark XII system,

Also, the enemy can exploit the system

Thus, pilots, for example, are faced with the serious dilemma of turning on their Mark XII equipment and permitting enemy exploitation or turning it off and being declared a foe by friendly air defense forces. Because of this uncertainty, combat rules of engagement frequently require a positive visual identification to be made before an engagement. This puts a severe restriction on our modern weapons which are capable of being launched far beyond visual identification range as well as places the delivering weapon system in unnecessary danger. The need for improved identification capabilities is well documented. In March 1978 the North Atlantic Treaty Organization's Long Term Defense Program Task Force Five on Air Defense

Similarly, the need for improved identification capability has been documented by Tactical Air Command Statements of Need 304-79 and 305-79 and most recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980. This project is part of a Tri-Service (Air Force led) effort, under the Combat Identification System (CIS) Program, to evolve comprehensive and balanced improvements to United States (U.S.) identification capabilities worldwide. For these improvements to have maximum effectiveness they must be interoperable with the identification capabilities of U.S. allies. To this end the U.S. is cooperating with the other North Atlantic Treaty Organization (NATO) nations to reach agreement on the basic operating characteristics (e.g., signals-in-space) of future identification equipment. The work in this project addresses direct, cooperative techniques of identification (e.g., use of cryptographically secure questions and answers). This work is complemented by direct, non-cooperative and indirect identification techniques being pursued by other projects within this and other program elements. Fiscal year 1981 funding for this project was deferred by Congress because of concerns over the need for additional program planning and NATO agreement. As a result, the program was rescope and focused toward developing information needed to improve the basic program plans as well as to establish a U.S. position as a basis for reaching agreement with the other NATO nations. Specifically, after notifying Congress of Air Force intent to do so, concept definition and associated supporting contracts were awarded using available fiscal year 1980 funds. These contracts are investigating various alternative approaches to achieving a new direct, cooperative (question and answer) identification system, the technology development required, the cost-effectiveness of the various approaches and the impact of integrating such a system into the weapon system. This type of information is needed to support further development and definition of comprehensive plans and agreements for the program. The current funding will support the contracts to 1 May 1981. The contracts include provisions for termination if fiscal year 1981 funding is not available to complete the work. This would require reinitiation of procurement for concept definition studies in fiscal year 1982 with a resultant slip in the direct, cooperative identification

Project: #2599

Program Element: #63742F

DOD Mission Area: Tactical Command and Control, #254

Title: Cooperative Identification Technology
Title: Tactical Identification Systems

Budget Activity: Tactical Programs, #4

program of twelve to eighteen months. However, as a result of the Senate Appropriation Committee language, which encouraged the DoD and Services to continue efforts in preparation for an accelerated development and deployment of next generation identification systems, reprogrammed fiscal year 1981 funds are expected to be available to continue the effort. This will allow completion of the concept definition work in fiscal year 1982 and will provide a basis to review alternative approaches for improving or replacing the aging Mark XII identification system. The thrust of the near term effort will be the selection of design approaches for which advanced development models will be competitively built and tested. The results of such tests will be the basis for defining the role and contribution of direct, cooperative identification in improving overall U.S. identification capabilities considering other complementary identification techniques (e.g., direct, noncooperative and indirect). The testing will also provide the basis for obtaining interoperability agreement with the other NATO nations.

(U) RELATED ACTIVITIES: The Cooperative Identification Technology Project will be implemented in close coordination with all efforts under the Combat Identification System (CIS) Program. These efforts include the following program elements: Program Element (PE) 64725F, Aircraft Identification Systems; PE 63706A, Identification Friend or Foe; PE 64709A, Identification Friend or Foe; PE 63515N, Advanced Identification Technology; PE 63267N, NATO Identification System; and PE 64211N, AIMS/ATCRBS/MK XII. The work under Project 2599 will transition to PE 64725F, Project 2598 for engineering development.

(U) WORK PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command (AFSC), Wright-Patterson Air Force Base, OH manages this project. Additionally, project support is provided by Rome Air Development Center, AFSC, Griffis's Air Force Base, NY. The following contractors provide support for this project: Bendix Corp., Baltimore MD; Dynamics Research Corp., Wilmington MA; E-Systems, St. Petersburg, FL; Harris Corp., Melbourne, FL; Hazeltine Corp., Greenlawn, NY; Harris Corp., Melbourne, FL; Martin-Marietta Corp., Orlando, FL; Raytheon Co., Sudbury, MA; Texas Instruments Corp., Dallas, TX; and Veda Corp., Arlington, VA. Major support is also provided by Massachusetts Institute of Technology Lincoln Laboratory, Lexington, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This project was initiated in fiscal year 1979 with several studies of technology that could be applied in the design of a cooperative identification system. During fiscal year 1980 high technology components that could support a specific design implementation of a cooperative, question and answer identification system were fabricated and tested by Lincoln Laboratories. The information developed from these activities helped to define the technical specifications for the United States requirements in this area. Additionally, the information established the basis for the United States to assure its requirements are adequately addressed in NATO's effort to develop a standardization agreement (STANAG) for fostering the interoperability of future NATO identification systems.

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Project: #2599

Program Element: #63742F

DOD Mission Area: Tactical Command and Control, #254

Title: Cooperative Identification Technology

Title: Tactical Identification Systems

Budget Activity: Tactical Programs, #4

2. (U) FY 1981 Program: Fiscal year 1981 funding for this project was deferred by Congress due to concerns over the need for additional planning and NATO agreement. The program is focused on addressing these concerns. Strong emphasis on front end planning activities has already resulted in an approved Joint Mission Element Need Statement, a Tri-Service Charter for strong, centralized program management and a Tri-Service Program Master Plan. Additionally, to support United States efforts to achieve NATO agreement as well as to support detailed development planning activities, concept definition and supporting contracts were awarded (after notifying Congress) using available fiscal year 1980 funding. It is expected that as a result of these activities the United States will be able to reach agreement with the other NATO nations on a STANAG. This STANAG will be suitable for guiding the various national development efforts while still allowing the exploration of cost effective, alternative approaches and providing a basis to insure the interoperability of future identification systems.
3. (U) FY 1982 Planned Program: Concept definition contracts for alternative design approaches of a cooperative (question and answer) identification system will be completed. This is expected to allow the selection of at least two design approaches to begin fabrication of advanced development models for testing. Technology application and supporting studies will continue to determine the most effective level of performance to build into a question and answer system. The increase of \$5.5 million in fiscal year 1982 reflects the adjustment made to offset the schedule impacts of the fiscal year 1981 funding cut.
4. (U) FY 1983 Planned Program: Development of the cooperative, question and answer identification system will continue. Demonstration and validation testing of advanced development models will be conducted. Various cost effectiveness and supporting studies will be completed in preparation for a decision to transition to engineering development under PE 64725F.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable
7. (U) Resources:
- | Project Number | Title | FY 1980 Actual | FY 1981 Estimate | FY 1982 Estimate | FY 1983 Estimate | Additional to Completion | Total Estimate Costs |
|----------------|---------------------------------------|----------------|------------------|------------------|------------------|--------------------------|----------------------|
| 2599 | Cooperative Identification Technology | | 0 | 11,500 | To Be Determined | To Be Determined | To Be Determined |

609C

Project: #2599

Program Element: #63742P

DOD Mission Area: Tactical Command and Control, #254

Title: Cooperative Identification Technology

Title: Tactical Identification Systems

Budget Activity: Tactical Programs, #4

8. (U) Comparison with FY 1981 Budget Data:

Project Number	Title	FY 1979 Actual	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	Additional to Completion Costs	Total Estimate Costs
2599	NATO Identification System		3,000	12,000	6,000	Continuing	Not Applicable

The \$5.5 million increase in FY 1982 reflects the adjustment made to offset the schedule impacts of the fiscal year 1981 funding cut.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63745F

DOD Mission Area: Air Warfare Support, #225

Title: Chemical Warfare Defense

Budget Activity: Tactical Program #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Program to Completion
TOTAL FOR PROGRAM ELEMENT							
2722	Biomedical Chemical Warfare Defense			4,100	5,100	Continuing	Not Applicable
				4,100	5,100	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program, a new start in FY 1982, is designed to alleviate basic medical and operational problems associated with chemical warfare operations. The program will demonstrate improved technology solutions to enhance Air Force capabilities to sustain operations and handle casualties in a chemical warfare environment. This includes development of prototype equipment and operational procedures for crew protection, with emphasis on tactical air operations, aircrew and ground crew decontamination, and casualty handling. The program will be performed by the Aerospace Medical Division, Brooks Air Force Base TX, which includes the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base OH.

(U) BASIS FOR FY 1982 RDT&E REQUEST: With increased indications that the Soviet Block countries would use chemical weapons in a conventional conflict, the United States must step up their efforts to protect against chemical warfare attack. We strongly believe that the most serious near-term aspect of the United States posture is the state of our defensive capability and ability for our forces to operate and survive in a chemical warfare environment. In coordination with the Army, who is lead Department of Defense agent for overall chemical warfare defense, this advanced development program, planned for initiation in FY 1982, will address the United States Air Force chemical warfare defense needs. The FY 1982 planned program includes efforts to develop improved chemical defense aircrew personal protective equipment to alleviate the problems of thermal stress, lack of dexterity, limited visibility, and encumbrance inherent in the current off-the-shelf aircrew equipment. Additionally, new resin polymer technology will be used to develop a functionally acceptable aircrew breathing filter and a miniature cockpit chemical agent detector employing the latest state-of-the-art electrochemical technologies. In addition, air base and air evacuation medical concepts and procedures employed in a chemical warfare environment will be developed.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not applicable. New start in FY 1982.

(U) OTHER APPROPRIATION FUNDS: Not applicable.

(672)

Project: #2722

Program Element: #63745F

DOD Mission Area: Air Warfare Support, #225

Title: Biomedical Chemical Warfare Defense

Title: Chemical Warfare Defense

Budget Activity: Tactical Program #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Chemical Warfare Defense, in context with Aerospace Biotechnology, is the application of both existing and new biotechnology programs for the solution of particularly vexing chemical defense problems. Chemical Defense Biotechnology has been divided into five key areas associated with personal protective equipment, airbase operations, medical operations and equipment, crew performance, and field demonstrations. In the solution of these problems, we intend to develop improved aircrew filter systems and protective equipment compatible with current aircraft design; develop service life indicators of cockpit air filters and crew member protective clothing; develop miniature chemical agent detectors which fit the cockpit; develop specific medical and air evacuation support equipment such as vital signs indicators, multichannel respiratory support equipment, and decontamination apparatus. Absolute efficiency will be necessary to transport, decontaminate, and stabilize even the moderately injured or chemically intoxicated. We, therefore, intend to develop a complete and highly mobile second echelon prototype system, including integrated transportation, decontamination and treatment equipment, and a supportive technology for medical care and casualty flow in a toxic chemical environment.

(U) RELATED ACTIVITIES: The Air Force Chemical Warfare Defense program is formally coordinated with the other Services. The Army is recognized as the lead Department of Defense agent for overall Chemical Warfare Defense. Only efforts that have specific Air Force relevance or can be accomplished by the Air Force's technical expertise more economically will be addressed in this program. Areas that have multiservice interest and are not unique to the Air Force are identified to the Army, which is the executive agent for chemical defense research. The program is also coordinated on an international basis through the Air Standardization Coordinating Committee. In addition, bilateral efforts have been established with the United Kingdom Institutes of Aviation Medicine, and the Chemical Defense Establishment. Liaison is maintained with Air Force operational commands.

(U) WORK PERFORMED BY: The Chemical Warfare Defense Research and Development Program is conducted by the Aerospace Medical Division through its two laboratories: the United States Air Force School of Aerospace Medicine, Brooks Air Force Base TX, and the Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base OH. The in-house portion of the program is centered on unique, complex, man-rated experimental facilities which are generally not available in the aerospace industry or academic institutions. The contract portion of the program complements the in-house efforts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: None, this is a new start.
2. (U) FY 1981 Program: A project was established in PE 62202F, Aerospace Biotechnology, to provide chemical defense exploratory development technology for this program.
3. (U) FY 1982 Planned Program: The FY 1982 planned program includes new thrusts centered at the development of a prototype chemical defense respirator, a resin polymer filter, liquid cooled garment prototype, a miniature aircraft cockpit detector and patient decontamination devices. In addition, medical concepts, operations, and equipment for medical air evacuation will be investigated.

Project: #2722

Program Element: #63745F

DOD Mission Area: Air Warfare Support, #225

Title: Biomedical Chemical Warfare Defense

Title: Chemical Warfare Defense

Budget Activity: Tactical Program #4

.. (U) FY 1983 Planned Program: The FY 1983 planned program will include the developmental test and evaluation of prototype aircrew respirators, resin filters, and liquid cooled garments. New efforts will begin to develop a prototype vital signs monitor for use in air evacuation missions, develop aircrew contamination control procedures and integration of chemical defense equipment with current life support equipment.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63747F

Title: PAVE MOVER

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Budget Activity: Tactical Programs, #4

RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,590	13,100	5,300	2,100	8,200	58,190

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A critical need exists for a revolutionary new capability to attack numerically superior Warsaw Pact second echelon armored mobile ground forces. To fill this need, the Department of Defense has undertaken the Assault Breaker, a cooperative standoff anti-armor concept, as a high priority initiative. PAVE MOVER is the Assault Breaker radar sensor and control subsystem which will:

BASIS FOR FY 1982 RDT&E REQUEST: The Assault Breaker End-to-End Demonstrations will be completed, and the PAVE MOVER System will meet a Electronic Counter Countermeasures and target discrimination capabilities for transition into the Full Scale Engineering Development PAVE MOVER activities conducted in Program Element 64616F, Air Launched Assault Breaker. Cost estimates are based on contractor inputs and independent cost estimates.

COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	6,700	13,200	5,100		35,700	79,700*

* Pave Mover Full Scale Development funds had been programmed in the Pave Mover Full Scale Development was re-structured in Program Element 64616F, Air Launched Assault Breaker, and funding in Program Element 63747F was adjusted accordingly. if feasible. Since

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63747F

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, # 255

Title: PAVE MOVER

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The PAVE MOVER Program (formerly the Low Visibility Moving Target Acquisition Strike Program) was established to develop advanced techniques and equipment for detection, location and attack of moving ground vehicles from stand-off ranges. In 1978, the PAVE MOVER advanced development work was restructured as a jointly funded Air Force/Defense Advanced Research Projects Agency effort which supports the Assault Breaker Concept. The primary objective is to develop a hybrid Moving Target Indicator/Fixed Target Indicator radar suitable for fixed wing aircraft applications, and demonstrate that a system using the data from one or more such radars can locate stopped or moving ground targets with sufficient accuracy and timeliness to conduct effective tactical standoff attack operations. Attack options will include,

Major program efforts include radar and ground processor development hardware and software demonstrations in the FY 1981-1982 Assault Breaker End-to-End field demonstrations; and detailed investigation into radar performance, system accuracy, required processor capability, determination of command and control interfaces, development of radar target discrimination techniques, development of electronic counter-countermeasure features, and force structure cost and impact.

Preliminary studies had indicated that

However, final studies on the possibility of

Accordingly, the out-year funds
are now programmed as a separate project in PG 64616F, Air Launched Assault Breaker.

Similarly, the PAVE MOVER

desirable PAVE MOVER platform features include (1) the ability to
(2) a ground fire control subsystem for interoperability with the Army and at least a partially self-contained fire control subsystem capability on the same platform
(3) a capability for

and (4) a capability to operate at

Two platforms -- the B-52 and the C-130 -- are among the primary aircraft currently being considered to carry the PAVE MOVER radar. The B-52 emphasizes the attributes of a

since the B-52 will also carry

the Assault Breaker Air Launched Missile. The C-130 emphasizes the aircraft

Platform selection will be reviewed at the Defense Systems Acquisition Review Council

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(78)

Program Element: #63747P

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: PAVE MOVER

Budget Activity: Tactical Programs, #4

A specific PAVE MOVER advanced development achievement is the development of a moving target indicator radar employed on a fixed wing aircraft, which is capable of detecting and tracking

also includes a small area spot image radar mode
the detection/track of stopped vehicles, positionable out

abeam of the aircraft. PAVE MOVER efforts to preclude enemy exploitation and interference include not only advanced development of low probability of intercept techniques to enable the radar signal to remain undetected by enemy receivers; but also include electronic countermeasure measures techniques to counter enemy attempts to jam the radar. To provide a high probability of timely target destruction or mobility kill, weapon guidance/aircraft strike cueing will use the PAVE MOVER radar's inherent internal ability to accurately determine the relative position/velocity of a target with respect to a weapon to guide multiple weapons using the as the communication link. Alternatively, a can be used for guidance/weapon delivery. Total system

strike accuracy (including target location, weapon location and guidance and control errors) using the PAVE MOVER is estimated
Strike accuracy with a

RELATED ACTIVITIES: There is no other system planned to provide real time aircraft cue vectoring and/or standoff missile guidance against second echelon armor. Currently, this mission

PAVE MOVER Full Scale Engineering Development is conducted under PE 64616F, Air Launched Assault Breaker. The PAVE MOVER radar and Army's Stand-Off Target Acquisition System (SOTAS) radar, being developed under PE 63736A, are also complementary and cooperative programs. SOTAS addresses the need for an Army Division level asset to counter the near forward edge of the battle area enemy armor problem while the PAVE MOVER radar is intended as a theater resource for wide area battlefield management and attack to include second echelon elements. The surface-to-surface missiles, which will be guided by PAVE MOVER during the Assault Breaker End-to-End demonstration, are also candidates for the Army's Corps Support Weapon System. The Assault Breaker Air Launched Missile, developed under PE 64616, Air Launched Assault Breaker, will be guided by the PAVE MOVER. Formal liaison is maintained between the Services through the Assault Breaker Steering Group and the Assault Breaker Executive Committee comprised of appropriate civilian executive from the Office of the Under Secretary of Defense for Research and Engineering, the Defense Advanced Research Project Agency (DARPA), and Air Force and Army General Officers. The PAVE MOVER is being jointly funded by the DARPA program elements PE 62702E and 62711E. The DARPA portion of this effort includes 6.8 million dollars in FY 1979 and prior, 7.75 million dollars in FY 1980, 8 million dollars in FY 1981, and 2.5 million in FY 1982 which includes both PAVE MOVER development costs and the DARPA share of the Assault Breaker demonstration costs. This joint Air Force/DARPA PAVE MOVER program supports the Assault Breaker concept.

(U) WORK PERFORMED BY: This advanced development program is being managed by the Rome Air Development Center, Electronic Systems Division, Griffiss AFB, NY. The PAVE MOVER Responsible Test Organization is the Armament Division 3246th Test Wing, Eglin AFB, FL. An Air Force Assault Breaker/PAVE MOVER System Program Office has been established at Headquarters, Electronic Systems Division, Hanscom AFB, MA to manage Full Scale Engineering Development of the effort in PE 64616F,

Program Element: #63747F

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: PAVE MOVER

Budget Activity: Tactical Programs, #4

Air Launched Assault Breaker - taking products from this program element. The Air Force Test and Evaluation Center, Kirtland AFB, NM will evaluate Assault Breaker demonstration results for overall operational suitability for Air Force missions. The MITRE Corp Bedford, MA will assist the Program Office in overall Assault Breaker concept studies, test planning and evaluation of demonstration results, and well assist government personnel in studies prior to engineering development. Lincoln Laboratories, Lexington, MA will assist the Program Office in evaluating/documenting the PAVE MOVER radar performance during the FY 1981 demonstrations. The PAVE MOVER dual prime radar/ground subsystem (competing) contractors are Hughes Aircraft, Culver City, CA, and Grumman/Norden, Norwalk, CT.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

The Multiple Antenna Surveillance Radar (MASR) developed and flight demonstrated by Lincoln Laboratory through FY 1979, is the brass board predecessor of the PAVE MOVER program. It employs a Displaced Phase Center Array antenna for — and a coherent radar system featuring adaptive digital processing to provide a capability to

from a single platform. A proof-of-concept brassboard test model was fabricated and demonstrated on a Twin Otter aircraft. MASR proof-of-concept flight testing was initiated in July 1976. As a part of this development activity, Lincoln Laboratory conducted an extensive investigation of the electronic counter measure vulnerability of the MASR. A number of recommendations surfaced which have been incorporated into the PAVE MOVER development. MASR development included

Final MASR demonstrations, concluded in FY 1979, included highly accurate, automatic moving target indicator radar detective,

which enable the radar processor to automatically

The MASR also demonstrated processor algorithms for —

out in FY 1979.

The MASR was phased

(U) During FY 1976, Westinghouse completed a study of alternative radar approaches. This study concluded that superior performance, lower risk development, and greater operational utility would be achievable by going to non-displaced phased center array techniques, higher frequency, and advanced pulse doppler filter processing techniques. This has resulted in the definition of the PAVE MOVER radar development. Subsequent analyses have led to the decision to phase out the MASR program in FY 1979 and focus development on the PAVE MOVER Radar. A dual contract has been awarded for the competitive procurement of the PAVE MOVER radar as a joint Air Force/Defense Advanced Research Projects Agency program in support of Assault Breaker. Contract awards were made in the fourth quarter, FY 1978, to two competing contractors (Hughes Aircraft and Grumman/Norden). PAVE MOVER Preliminary Design Reviews and Critical Design reviews were accomplished. Hardware development of the PAVE MOVER airborne radar and ground substations continue on schedule.

Program Element: #63747F

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: PAVE MOVER

Budget Activity: Tactical Programs, #4

Class II Modification packages to install the PAVE MOVER radar on a F-111 (one F-111 installation for each of the competing radars) were completed. Checkout of the complete PAVE MOVER, to include radars, ground subsystems, off-the-shelf data links and software/hardware development for the Assault Breaker demonstrations has been completed. The studies on merging PAVE MOVER and Advanced Synthetic Aperture Radar have concluded that the merger is not feasible. A PAVE MOVER Test and Evaluation Master Plan has been annexed to the Assault Breaker Demonstration Plan. Assault Breaker Concept Definition studies were completed in FY 1980. A Concept of Operations and Mission Element Need Statement is being prepared for Assault Breaker/PAVE MOVER.

2. (U) FY 1981 Program: Demonstrations of stand-off cooperative strike will be conducted using the two PAVE MOVER competing radars. The demonstration is broken into two phases: (1) baseline PAVE MOVER demonstrations; and (2) Assault Breaker End-to-End demonstrations. The baseline PAVE MOVER radar demonstrations include: (1) radar/ground subsystem checkout and accuracy verification experiments; (2) demonstration of PAVE MOVER low probability of intercept and Electronic Counter-Counter Measures features, to include red team evaluation of radar electronic counter countermeasures resistance; and (3) demonstration of PAVE MOVER command guidance of short range air launched missiles (GBU-8 HOBOT missiles) launched from penetrating aircraft against ground targets. Following the baseline Air Force/PAVE MOVER demonstration, the PAVE MOVER will join the Army/Air Force/Defense Advanced Research Projects Agency in the Assault Breaker End to End demonstrations. The Assault Breaker demonstrations consist of a joint Army baseline demonstration segment, and an Air Force unique variant. The baseline demonstration consists of launching Army standoff surface to surface Corps Support Weapon missiles against multiple moving ground targets using PAVE MOVER for cooperative target acquisition and weapon guidance. The Air Force Assault Breaker variant demonstration consists of two segments. In the first segment, the PAVE MOVER will be used to acquire ground targets and guide standoff air launched missiles (specially configured air launched T-16 Patriot missiles, launched from a second standoff B-52 platform) against multiple movable ground targets. The second segment of the Air Force variant consists of using PAVE MOVER from a standoff high altitude platform to acquire and track moving ground targets, and to provide cue vectoring commands and target update information to a low altitude penetrating F-4 attack aircraft.

3. (U) FY 1982 Planned Program: The Assault Breaker End-to-End demonstrations will be concluded. PAVE MOVER will meet a Defense Systems Acquisition Review Council Milestone II decision point prior to beginning a Full-Scale Engineering Development program. The results of the demonstrations, user assessments and parallel studies will be used to re-structure the program, as required. Final PAVE MOVER platform determinations/system overall architecture will be made. Full Scale Engineering Development will begin under Program Element 64616F, Air Launched Assault Breaker.

4. (U) FY 1983 Planned Program: This program will develop and validate baseline capabilities for target discrimination, low probability of intercept, electronic counter-countermeasures, and passive-active emitter location to a directed threshold maturity prior to transition to PAVE MOVER Full Scale Development in Program Element 64616F, Air Launched Assault Breaker. This program will also develop man-machine inter-relationships with emphasis on development of automatic aids in the areas of weapon control and assignment, target recognition and designation, and sensor management.

Program Element: #63747F

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: PAVE MOVER

Budget Activity: Tactical Programs, #4

5. Program to Completion: Some unique target discrimination and electronic counter measures for the PAVE MOVER will remain in Advanced Development beyond FY 1982. All PAVE MOVER Engineering Development to include Development Test and Evaluation/Initial Operational Test and Evaluation is tentatively planned to be completed in the time frame. Effort under this Program Element will support Full Scale Engineering Development conducted under PE 64616F, Air Launched Assault Breaker.

6. Milestones:

EVENT

DATE

Defense Systems Acquisition Review Council II
Development Test & Evaluation/Initial Operational
Test & Evaluation
Air Force/Defense System Acquisition Review Council III
Initial Operating Capability

FY 1982 RDT&E Descriptive Summary

Program Element: #64201F

Title: Aircraft Avionics Equipment Development
Budget Activity: Tactical Program, #4

DOD Mission Area: Interdiction/Naval Strike, #223

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Complete	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2257	Standard Avionics	14,599	23,910	13,100	20,000	Continuing	N/A
2258	Standard Medium Accuracy Navigation	1,650	1,810	1,900	3,000	Continuing	N/A
2259	Terrain Following Radar	450	0	0	0	0	14,924
2297	Software and Computer Standardization	100	100	0	0	0	200
2519	Radar Programmable Signal Processor	200	1,300	1,000	1,500	Continuing	N/A
2560	Jovial Language Control Facility	8,100	8,400	7,700	10,300	Continuing	N/A
2590	Standard Fuel Savings Advisory System	0	800	700	800	Continuing	N/A
2649	Advanced Medium Range Air-to-Air Missile (AMRAAM) Beyond Visual Range Operational Utility Evaluation	2,100	4,500	100	600	0	7,300
2771	Standard Central Air Data Computer	1,999	7,000	0	0	0	N/A
2772	Armament Integration	0	0	1,700	2,500	900	5,200
		0	0	0	1,300	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The high cost of operating and maintaining our forces is reducing operational capability and readiness. This program element develops standard architecture and airborne electronic equipment that will reduce support costs and allow technology evolution to provide overall operational force improvement. Typical products include a joint US Air Force/Navy air data computer specification, radar software applicable to tactical and strategic forces, and fuel savings systems to conserve at least 3% of trip fuel in the C-5, C-141 and C-135 aircraft.

(U) BASIS FOR FY 1982 REQUEST: Planning and acquisition of standard avionics equipment and software for all Air Force aircraft will continue. Application of radar signal processor software to the F-16 and other aircraft will be accomplished in project 2519 to provide improved air to air and air to surface capability. Engineering development of a standard air data computer for the USAF and Navy will begin. Costs are based upon a combination of negotiated contracts and engineering estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Complete	Total Estimated Costs
RDT&E	12,600	17,100	12,700		continuing	N/A

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64201F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Aircraft Avionics Equipment Development
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program has been established to permit engineering development of avionics that are candidates for standardized equipment for future aircraft or modifications to existing aircraft. No other program element provides the specific application engineering necessary to translate the results of advanced development programs to actual form, fit, and function standard equipment for navigation, radar processing and other avionics needs. For example, the Standard Precision Navigator was transitioned from an advanced development program, Advanced Avionics for Aircraft (63203F) where feasibility was demonstrated, to Program Element 64201F where an engineering development model was purchased for broad application to Air Force aircraft. The fuel savings advisory system program is an example where this program element is adapting commercially developed equipment to a variety of Air Force application. Standard avionics multiplex control equipment, compatible processor hardware, software, and advanced displays will be developed through this program element. The project for standardization and improvement of airborne radars is directed at the existing and evolving Warsaw Pact threat which is increasing in numbers, capability and electronic countermeasures performance. Without this specific program, separate, costly development programs for each individual aircraft application would be conducted.

(U) RELATED ACTIVITIES: This program is closely coordinated with the Army and Navy to maximize joint developments where feasible. A tri-service memorandum of agreement has been established to promote interservice standardization. Currently a joint effort with the Navy's Program Element 64203N, Avionics Components and Subsystems, is underway to develop a standard air data computer. There is a close relationship between the products of this program and the technological building blocks developed in advanced and exploratory and development programs such as PE 63203F, Advanced Avionics for Aircraft; and PE 62204F, Aerospace Avionics. Techniques, components and subsystems showing a high payoff potential can be progressively transitioned through the development process until a specific weapon system application is identified and engineering development task established. The radar programmable signal processor project investigates the generic radar improvements possible through initial application in the F-15 and F-16. Electronic Counter-Counter Measures test data obtained from PE 63750F will be used in developing software for the project. Avionics standards developed under this program will be transitioned to PE 64219F (Integrated Digital Avionics) for application and maintenance.

(U) WORK PERFORMED BY: Program management will be provided by elements of the Air Force Systems Command with all projects under the direction of the Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contracts of Project 2257 are with The Analytic Services Corporation, Redding, Massachusetts and Aeronautical Radio Inc, Annapolis, MD. Project 2519 is contracted with Hughes Aircraft Corporation, Culver City, California through McDonnell Douglas for the F-15 and with Westinghouse Electric Corporation, Baltimore, Maryland for F-16 application. The Project 2560 contractor is SOFTEC Inc., Waltham, Massachusetts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Common Strategic Doppler and Standard Medium Accuracy Navigator completed development and were adopted as Air Force standards. An Air Force/Army/Navy agreement was established to provide for joint standard equipment development with a standard air data computer initiated as the first system. An Avionics Master Plan and Avionics Planning Guide were completed to guide Air Force avionics development and acquisition. Electronic Counter Counter Measures (ECCM) deficiencies and improvement modifications to the F-111 Terrain following radar

Program Element: #64201F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Aircraft Avionics Equipment Development
Budget Activity: Tactical Program, #4

were identified. Testing of the Radar Programmable Signal Processor software began flight test in an F-15 test bed incorporating added capabilities such as Track While Scan and improved ECOM. Flight testing of fuel savings hardware on KC-135 and C-141 aircraft was completed verifying conservation of at least 3% of trip fuel. Simulator design to conduct operational utility evaluation of the Advanced Medium Range Air-to-Air Missile (AMRAAM) was initiated.

2. (U) FY 1981 PROGRAM: Project 2257 will continue to plan avionics acquisition and identify candidates for standardization. Standard air data computer development will be initiated. Comprehensive testing of radar programmable signal processor software in the F-15 test bed will be conducted and transition of the software to the F-16 will be initiated. Design studies of application of the programmable signal processor to other aircraft will be conducted. Project 2297 will implement the standard instruction set architecture (MIL-STD-1750A) in a minicomputer to provide application of MIL-STD-1750A as the initial step in reducing the proliferation of embedded computers. Operation of the Jovial Language Control facility will transition to Aeronautical Systems Division to control standard support software. The facility will support the F-111 conversion to J-73. In project 2590 commercially available fuel savings equipment and handheld calculators will be adapted for use on the C-5, C-141, and C/KC-135 aircraft. Additional FY 1982 and FY 1983 funding (\$3.0M) will be required to complete the Fuel Savings Advisory System simulators and support equipment. Project 2649 will conduct man-in-the-loop testing to evaluate operational utility of the AMRAAM.
3. (U) FY 1982 PLANNED PROGRAM: Project 2257 will continue to control Air Force avionics developments and identify candidates for standardization to reduce proliferation and improve supportability. In project 2519, F-15 programmable signal processor testing will be completed. Specific development for the F-16 will be conducted to incorporate modes developed for the F-15 and added air-to-ground modes needed for the F-16. Development of the Multi-Role Radar for the new bomber will be supported. The computer and software standardization effort in project 2297 will continue with delivery of the first MIL-STD-1750A minicomputer. New tasks will include a software transportability demonstration. Transition of the project 2560 Jovial Language Control Facility will be completed. The standard central air data computer development initiated in 2257 will be continued as a new project 2271. Changes in funding between the FY 1981 and FY 1982 Descriptive Summaries are due to inflation. The terrain following development initiated in project 2259 has been incorporated into the project 2519 radar programmable signal processor effort.
4. (U) FY 1983 PLANNED PROGRAM: Avionics planning and standardization will continue in project 2257. Project 2297 computer and software standardization will continue with delivery of small quantities of MIL-STD-1750A microcomputers. Project 2519 F-16 programmable signal processor testing will be conducted in depth and application of the signal processor technology to the new bomber will be initiated. The project 2560 Jovial language control facility will be in full operation supporting all DOD users of Jovial. The air data computer development will be continued, with completion in FY 1983. A new project to standardize armament integration will be initiated.
5. (U) PROGRAM TO COMPLETION: This is a continuing program.
6. (U) MILESTONES: Not applicable.

Project: #2519

Program Element: #64201F

DoD Mission Area: Interdiction, #422

Title: Radar Programmable Signal Processor

Title: Aircraft Avionics Equipment Development

Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Warsaw Pact employment of large scale operations produces a significant air-to-air targeting problem. They also display the capability for round-the-clock armor attack in all weather operations. Significant improvements in the number and sophistication of the threat requires penetrators to fly at the lowest possible altitude. Radar electronic counter-counter measures (ECCM) are needed to make fighter and bomber aircraft less susceptible to air-to-air and air-to-ground electronic counter measures. All weather beyond-visual-range identification, track while scan, ECCM protection and raid assessment are needed to aid pilots make optimum missile launch decisions. Also, Terrain Following/Terrain Avoidance, high resolution ground map, and ground moving target capability are needed in both tactical and strategic operations. The generic radar programmable signal processor program will develop and demonstrate algorithms which provide these improved capabilities. F-15 and F-16 test bed aircraft will be used to test the software developed initially under this program. The project will perform a coordinated series of efforts which will develop radar processor capabilities for many aircraft. The F-15 and F-16 radars and Multi-Role Radar for the Multi-Role Bomber effort will specifically take advantage of the technological opportunity provided by this project.

(U) RELATED ACTIVITIES: F-15 Radar programmable signal processor hardware was developed by PE 27130F for the F-15 APG-63 radar. Non-cooperative identification techniques and equipment are provided by PE 63742F/1177. Efforts are carefully reviewed to ensure that they are not duplicative. The Electronically Agile Radar program PE 62341F provides some of the air-to-surface technology for the programmable signal processor. F-16 radar programmable signal processor hardware development is being accomplished under PE 27133F. The efforts from project 2519 will be used to support F-15 and F-16 aircraft for selected improvements, the Long Range Combat Aircraft, and other USAF aircraft where appropriate.

(U) WORKED PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command, Wright-Patterson AFB, OH manages this project. The project receives support from the Air Force Avionics Laboratory, Wright-Patterson AFB, OH. The project contractors are McDonnell Douglas Aircraft Company, St Louis, MO, and the Hughes Aircraft Corporation, Culver City, CA for the F-15. F-16 related work will be accomplished by Westinghouse Corporation, Baltimore, MD and General Dynamics Corporation, Ft Worth, TX.

Project: #2519

Program Element: #64201F

DOD Mission Area: Interdiction, #422

Title: Radar Programmable Signal Processor

Title: Aircraft Avionics Equipment Development

Budget Activity: Tactical Program, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: Software development of track while scan, passive ranging, and long range search enhancement modes were completed. Roof house testing was conducted and flight test in an F-15 aircraft began. Studies of F-16 radar programmable signal processor application were conducted.
2. (U) FY 1981 PROGRAM: Software development of improved multiple target displays, improved electronic counter-counter measures and noncooperative target recognition modes will be accomplished. Flight testing in an F-15 test bed will continue. Studies of application of the programmable signal processor to the F-16, new bomber and other aircraft will be conducted.
3. (U) FY 1982 PLANNED PROGRAM: Programmable signal processor software development for F-16 application will begin. The air-to-air modes developed for initial F-15 application will be adapted for F-16 use. Development will begin for air-to-ground modes (ground moving indication and track, hard target track, improved ground map resolution, and electronic counter-countermeasures). Specifications for standard application of the programmable signal processor and its software will be developed. Development of software to facilitate multiple application will be accomplished.
4. (U) FY 1983 PLANNED PROGRAM: Roof top testing of the new air-to-ground modes will be conducted. Flight testing in an F-16 test bed will be initiated. Testing of other aircraft applications will be conducted.
5. (U) PROGRAM TO COMPLETION: Initial Testing of the programmable signal processor and its modes providing advanced tactical and strategic mission capabilities will be completed in FY 1985. Continuing Radar programmable signal processor work will provide advanced tactical software/hardware and radar updates to improve operational usefulness, reduce life cycle costs and standardize radar technology to the extent possible.

6. (U) MILESTONES: Not Applicable.

7. (U) RESOURCES:

	FY 1980	FY 1981	FY 1982	FY 1983	Total
	Estimate	Estimate	Estimate	Estimate	Estimated
				to Completion	Costs
RD&E	8,100	8,400	7,700	10,300	Continuing
					N/A

8. (U) COMPARISON WITH FY 1981 BUDGET DATA: Funding was reduced since the operational utility evaluation originally planned for this project was broken out as project 2649 and subsequently transferred to PG 28808F.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64212F

Title Aircraft Equipment Development

DOD Mission Area: Interdiction/Naval Strike, #223

Budget Activity Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
1926	Aircraft Windshield Development	7,050	4,100	2,200	9,900	Continuing	Not Applicable
2098	Landing Gear Development	1,400	1,300	1,400	1,800	Continuing	Not Applicable
2145	Laser Acquisition Device	285	100	100	1,000	Continuing	Not Applicable
2228	Standard Cryogenic Cooler	527					1,725
2377	Airdrop Systems Support	5	5				2,135
2713	Aircraft Instruments and Displays	144	100	100	300	Continuing	Not Applicable
4366	Integrated Attack Avionics	76	100	100	1,500	Continuing	Not Applicable
5551	FAVE LOW III	93	495	500	500	Continuing	Not Applicable
2525	F100 Engine Diagnostic System (Transferred from Program Element 64229F)	120					3,900
		4,400	2,000				18,800
2709	Generic Turbine Engine Monitoring System				4,800	49,100	53,900

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Due to changing threat scenarios, equipment obsolescence and technological advancements, a need exists to update and modernize the aircraft force. A need also exists to correct deficiencies that exist in operational aircraft in the areas of safety and improved systems effectiveness. This program element represents a collection of different but related projects which develop, test, and evaluate a variety of aircraft subsystem equipment in response to these operational needs. Technological advancements in aircraft equipment are exploited and/or translated into operational hardware. This is the only engineering development program element which utilizes advanced state-of-the-art technology to develop windshield systems offering improved hazard resistance and reduced cost-of-ownership.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for projects that range in size and complexity from safety certification of equipment to be airdropped from Air Force cargo aircraft to development of a bird impact resistant windshield for T-38 aircraft. All of the FY 1982 projects are continuing efforts that apply latest technology in correcting operational aircraft deficiencies in the areas of windshields, landing gear, instruments and displays, avionics, and airdrop systems. The cost estimates are derived based on past experience with similar efforts. The estimates are revised as of September 1980.

Program Element: #64212F

DOD Mission Area: Interdiction/Naval Strike, #223

Title Aircraft Equipment Development
Budget Activity Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Deficiencies in operational force aircraft due to changing threat scenarios, equipment obsolescence and advancements in technology are documented by command required operational capability documents. Various requirements addressed by this program element are as follows: Tactical Air Command Required Operational Capability 26-71, Improved F-111 Transparency Windshield; Tactical Air Forces Statement of Need 319-79, Post-Attack Launch Recovery; Air Force Logistics Command Required Operational Capability 2-74, Airborne Cryogenic Cooler; Tactical Air Forces Required Operational Capability 312-77, Cockpit Television Sensor; Military Airlift Command Required Operational Capability 19-70, Night/Adverse Weather Rescue System; and Department of Defense Directive 3224.1, Engineering for Transportability. The objective of this program element is to develop, test and evaluate a wide variety of aircraft subsystem equipments in response to these operational needs. The equipments involved are characterized by their installation on or within the aircraft. Following is a brief description of each of the projects within the program element which will be on-going in Fiscal Year 1982. Project 1926, Aircraft Windshield Development applies the latest technology to achieve bird impact resistance while maintaining high optical quality and light weight. F-111 bird impact resistant windshields have been developed in this project and effort will now be concentrated on the F-16 and T-38 aircraft. Project 2098, Landing Gear Development applies landing gear technological improvements in the areas of high temperature wheels and brakes and carbon disc brakes in an effort to improve performance, decrease acquisition costs, and reduce operation and support costs. Project 2377, Airdrop Systems Support, provides the method by which the United States Air Force carries out its responsibilities as executive agent (designated by the Joint Technical Coordinating Group on Air Drop) for development and testing of on-board airdrop systems. Project 2713, Aircraft Instruments and Displays, maintains cognizance of new technologies in this area and exploits these advancements to improve/solve operational deficiencies of currently operational controls and displays systems. Project 4366, Integrated Attack Avionics, integrates and tests the latest developments in the avionics/weapons areas to develop interface techniques which will assure optimum weapon delivery in high performance aircraft.

(U) RELATED ACTIVITIES: Program Elements 62201F, Aerospace Flight Dynamics; 63211F, Aerospace Structural Materials; 63246F, Aircraft Subsystems Technology; and 63203F, Advanced Avionics for Aircraft are related to this program element in that this element provides a means for completing the Engineering Development required to introduce equipment into the operational inventory.

(U) WORK PERFORMED BY: Program management is provided by the Air Force Aeronautical Systems Division and Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH. In-house test facilities involved in projects under this program element include the Wright Aeronautical Laboratories (Flight Dynamics, Materials, Structure, and Avionics Laboratories) at Wright-Patterson Air Force Base, OH; the Air Force Flight Test Center, Edwards Air Force Base, CA; Arnold Engineering and Development Center, Tullahoma, TN; Tactical Fighter Weapons Center, Nellis Air Force Base, NV; and the Armament Development and Test Center, Eglin Air Force Base, FL. Contractors include McDonnell Douglas Corporation, Long Beach, CA; and St. Louis, MO; General Dynamics, Fort Worth, TX; Hughes Aircraft Company, Culver City, CA; B. F. Goodrich, Akron, OH; Sierracin Corporation, Sylmar, CA; Pittsburgh Plate Glass Company, Pittsburgh, PA; Honeywell Incorporated, Minneapolis, MN; Bendix Corporation, South Bend, IN; Cryogenics Technology Incorporated, Boston, MA; Goodyear Aerospace Corporation, Akron, OH; and Dunlop Limited, Coventry, England.

Program Element: #64212F
 DOD Mission Area: Interdiction/Naval Strike, #223

Title Aircraft Equipment Development
 Budget Activity Tactical Programs, #4

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E							
Procurement (Other) (PE 27596F)		7,900	4,200	4,500		Continuing	Not Applicable
	Laser Acquisition Device (Quantity)	6,200 (251)	6,900 (400)	6,400 (400)	14,300 (800)		33,800 (1851)
Procurement (Aircraft) (PE 27433F)							
	Cockpit Television Sensor (Quantity)	8,100 (746)	9,000 (480)	6,500 (669)	25,900 (2035)		54,000 (4293)
(U) OTHER APPROPRIATION FUNDS:							
Procurement (Other) (PE 27596F)							
	Laser Acquisition Device (Quantity)		6,900 (178)	6,600 (350)	7,100 (350)	7,600 (350)	28,200 (1228)
Procurement (Aircraft) (PE 27433F)							
	Cockpit Television Sensor (Quantity)	9,100 (746)	9,000 (480)	6,500 (669)	5,300 (514)	20,800 (1521)	55,200 (4293)

(191
 626 691

Program Element: #64212F

DOD Mission Area: Interdiction/Naval Strike, #223

Title Aircraft Equipment Development
Budget Activity Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The following are examples of prior accomplishments under this program element. A second source/alternate design (lightweight) bird impact resistant windshield has been qualified and is being procured and retrofitted into F-111 series aircraft. A decision was made to procure a new F-16 canopy with improved bird impact resistance. Test and evaluation of titanium wheel/carbon brake assemblies was completed as was service testing of carbon disc brakes supplied by multiple vendors. Development of the Helmet Mounted Laser Acquisition Device and the Standard Cryogenic Cooler was completed. Development and testing of PAVE LOW III, the night/adverse weather/all terrain search and rescue modification of the HH-53 helicopter have been completed. Aircraft retrofit is now complete. An air drop systems support project designed to insure safety certification of all equipment to be air dropped from Air Force cargo aircraft was initiated. The competitive preproduction development of a charge coupled device gun camera (Cockpit Television Sensor) to replace film type gun cameras in tactical aircraft was completed. Production of this unit has been initiated. Procurement was initiated for a newly modified tow plate for installation in C-130 aircraft equipped with the Low Altitude Parachute Extraction System. The F100 Engine Diagnostic System initiated a flight evaluation phase.
2. (U) FY 1981 Program: Operational Test and Evaluation/Durability Program of the new F-16 canopy will be initiated. Initial procurement of production quantities of the Helmet Mounted Laser Acquisition Device will be accomplished. Development of a split screen capability for the Cockpit Television Sensor will be initiated. The F100 Engine Diagnostic System will complete the flight evaluation phase and detailed data analysis will be initiated. Initiation of the Laser Acquisition Device production program was delayed to Fiscal Year 1981 due to loss of Fiscal Year 1980 funds to higher priority efforts.
3. (U) FY 1982 Planned Program: Development of a stronger bird impact resistant windshield for the T-38 aircraft will continue. Windshield development efforts will also include evaluation of coatings and the effects of rain erosion and in-service wear on impact resistance. Landing gear systems projects will continue to investigate materials and manufacturing techniques to improve gear component service life while reducing acquisition costs and operation and support costs. Development of a split screen capability for the Cockpit Television Sensor will be completed. First production article deliveries of the Helmet Mounted Laser Acquisition Device will occur. The Aerial Gunnery Fire Control System and Midair Prevention System projects have been cancelled due to lack of validated operational requirements. Fiscal Year 1982 funding reductions have delayed start of the Generic Turbine Engine Monitoring System project until Fiscal Year 1983 and reduced the scope of three other level of effort projects to a minimum sustaining level.
4. (U) FY 1983 Planned Program: During this period windshield development efforts will continue evaluating coatings and the effect of in-service wear on impact resistance. Production deliveries of the Helmet Mounted Laser Acquisition Device will continue. Landing gear improvement efforts will concentrate on material and manufacturing techniques investigations which improve service life and reduce costs. The Generic Turbine Engine Monitoring System project will be initiated based on the results of the F100 Engine Diagnostic System project and the A-10 Turbine Engine Monitoring System project.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64218F
 DOD Mission Area: Counter Air, #221

Title: Engine Model Derivative Program (EMDP)
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate TBD	Additional to Completion Continuing	Total Estimated Costs Not Applicable
	TOTAL FOR PROGRAM ELEMENT	39,300	73,905	25,100			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Engine Model Derivative Program (EMDP) is aimed at filling a void which existed in the engine management and acquisition process for 10 years. This program will conduct efforts to provide improvements in the specification characteristics (i.e., performance, durability/life, reliability/maintainability, and reduced risk of development) of in-service engines or those engines which have passed the equivalent of a military qualification test. This capability, when combined with new engine developments, will ensure that the Air Force has propulsion alternatives for near term and far term needs. The only other means today to provide this capability is through full scale weapon system development. The EMDP will conduct the early engineering development leading to a prototype engine. Full scale development will continue in a weapon system development program after validation of the requirement for increased capability.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Four efforts previously initiated will be continued in this fiscal year. The T56 derivative flight clearance test will be conducted in FY 1982 to demonstrate the durability of the T56 EMDP design and to clear the T56 for a limited flight test program in FY 1983. Two T56 derivative engines will be delivered to support the flight test program. A 50 hour Accelerated Mission Test (AMT) will be conducted on the F100 DFE to clear that engine for flight on the F-15 and F-16 aircraft. Two F100 derivative engines will be delivered in late FY 1982 to support the flight test program currently scheduled for early FY 1983. The program for the derivative TF34 engine will focus on an across the board thrust increase of 17% and improvements to hot section durability. Design of the new fan and turbine components will be completed and the component rig testing will be conducted. A program for a derivative TF33 engine to achieve a 10% reduction in Specific Fuel Consumption (SFC) will be continued. Both of these latter programs emphasize performance improvements while verifying durability improvements through AMT testing. The funding levels reflected in this Descriptive Summary are based upon contractual commitments for the T56 and F100 EMDPs and contractor estimates for a fixed price contracts for the TF34 EMDP and the TF33 EMDP.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Complete Continuing	Total Estimated Cost Not Applicable
RDT&E	39,300	48,600	23,100			

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64218F

DOD Mission Area: Counter Air, #221

Title: Engine Model Derivative Program (EMDP)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Engine Model Derivative Program (EMDP) fills a void which existed in the engine development process for 10 years by permitting the demonstration of growth potential for current operational engines. This function had been accomplished under the Component Improvement Program until 1968 when Congress directed that the Air Force discontinue the practice. Aircraft have historically increased in gross weight at the rate of 2 percent per year following their development. This historical factor, resulting from changes in roles and missions, increased threat, and the incorporation of more on-board equipment, demands that higher engine performance be available to maintain the system thrust to weight necessary to maintain weapon system performance. Until 1979, the only method to accomplish this growth engine performance was through a full scale development program. Under the current concept, promising advanced component and engine technologies proven under Air Force advanced development programs will be transitioned to the EMDP and applied to practice. Early engineering development will be accomplished through prototype engine demonstration. Full scale development will continue under the specific weapon system program after the requirement for increased performance has been validated. This process will greatly enhance the Air Force ability to respond quickly to changing system needs. Propulsion has always been a pacing factor in aircraft system development. EMDP will permit the Air Force to selectively pursue derivative engine demonstrations early in the development process. Component technologies chosen for demonstrating desired increased capability will focus on improved durability and life, reduced cost, and improved performance. The EMDP will perform the engineering development of the upgraded components, integrate it into the derivative engine, and conduct the proof test. The program will demonstrate prototype engines to a point that prototype new concepts and designs can be incorporated into a follow-on full scale weapon system development. The overall objective of this effort is to maximize long range benefits in cost and system requirements. It will provide for the major design changes in Air Force engines to achieve performance improvements for future programs including F-16, F-15, A-10, C-130 and C-141 aircraft.

(U) RELATED ACTIVITIES: For the requisite technology, this program draws gas generator "core" engine technology (high pressure compressor, combustor, and high pressure turbine) from Program Element (PE) 63216F, Advanced Turbine Engine Gas Generator. Fan, low pressure turbine, and limited engine test data are provided by PE 63202F, Aircraft Propulsion Subsystems Integration (APSI). Advanced component technology is also obtained from PE 62203F, Aerospace Propulsion. Other principle inputs including materials processing and component fabrication demonstrations come from PE 78011F, Manufacturing Technology Program. Activities conducted by the Navy, National Aeronautics and Space Administration, Army, and the propulsion industry in-house programs also constitute significant sources of technology. The Air Force and the Navy have a broad Memorandum of Understanding for joint cooperative propulsion programs in areas of common interest. Component Improvement Program efforts directed toward engine flight safety problems, service revealed difficulties, and the achievement of durability goals also complement the long term EMDP development process.

(U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The T56 program is being performed by Detroit Diesel Allison Division, Indianapolis, IN. The F101 DFE program is being conducted by the General Electric Company, Evendale, OH. The growth F100 engine program is run by Pratt and Whitney Aircraft, Government Products Division, West Palm Beach, FL. General Electric Company, Lynn, MA is a potential contractor for future effort.

Program Element: #64218F

DOD Mission Area: Counter Air, #221

Title: Engine Model Derivative Program (EMDP)

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Efforts were initiated to significantly enhance the performance of the T56 engine for the C-130 aircraft. New "core" engine components providing a 20-25 percent improvement in the hot day take-off power of the engine and a 10 percent reduction in the cruise specific fuel consumption of the engine were designed and their fabrication was initiated. Gas generator design improvements include new compressor aerodynamics, improved turbine materials application, and an improved combustor fuel injection design. The limited development program for the Alternate Fighter Engine/F101X was initiated following Congressional direction to transfer funds previously authorized and appropriated for reengineering the Navy F-14 aircraft to a joint Air Force/Navy engine development effort. The program is a limited development program which takes the F101 DFE engine through a flight cleared engine demonstration and subsequent limited flight tests in an F-16 and F-14 aircraft. Initial efforts were directed toward fabrication of new low pressure spool hardware (i.e., fan and fan turbine); fabrication of a new augmentor; and refurbishment of three engine cores from the B-1/F101 engine program. A fan stress test was completed to verify the design of that component. The F101 DFE successfully completed a 1000 equivalent mission hour test. A parallel effort was initiated to demonstrate growth capability for the F100 engine. Efforts are centered around improvement in the fuel control and augmentor components of the engine which will produce improved operability, survivability, and perhaps durability/life characteristics. These large engine efforts on the F100 and F101 DFE will assure that competition will be maintained in the high thrust fighter engine area both in the near term and far term.
2. (U) FY 1981 Planned Program: Three major engine efforts will be in their critical stages. A complete engine test for the T56 engine will be conducted. Power section tests of the T56 derivative engine will be completed to verify the performance improvements predicted from the results of the component rig testing and to verify the durability of the T56 EMDP power section design. Control system bench tests will also be completed in FY 1981. The F101-DFE successfully completed the tests required for flight clearance on the F-16. An 100 hour flight test program on the F-16 aircraft was initiated in December 1980. As of 19 Jan 1981, 6.1 flight test hours have been successfully completed without an engine related anomaly. This F-16 flight test program will be completed in FY 1981. The F101-DFE will also complete a second 1000 equivalent mission hour test in FY 1981 to clear the engine for flight test in the F-14 aircraft in late FY 1981. During this time period, a follow-on effort to continue development with this engine will be considered. The program would focus on additional extensive ground testing to verify engine durability and cost of ownership aspects of the F101 DFE. F100 growth engine efforts will be continued with the conduct of extensive integrated engine ground tests. The new augmentor and full control components will be installed on a flight engine, and comprehensive mission oriented cyclic testing will be conducted. Two new efforts are being initiated in FY 1981. The derivative TF34 program will be focused on providing 17% improvement in thrust with equivalent or better hot section durability. The derivative TF33 program will provide a 8-10% improvement in SFC for the C-141 and B-52H aircraft with an annual fuel savings potential of 62 million gallons.
3. (U) FY 1982 Planned Program: Efforts will be continued on the derivative F100 engine, and derivative T56 engine. F100 derivative engine efforts will be oriented toward continued altitude tests to verify the operability, and reliability aspects of the engine. A flight cleared engine test will be completed, and flight test engine modifications prerequisite to limited flight validation of the engine design improvements will be initiated. T56 engine efforts will culminate with a flight cleared engine test and subsequent modification of an engine for flight verification tests.

Program Element: #64218F

DOD Mission Area: Counter Air, #221

Title: Engine Model Derivative Program (EMDP)
Budget Activity: Tactical Programs, #4

A limited flight test program will be conducted on a C-130 aircraft in FY 1983. Successful flight demonstration could lead to purchase of a limited number of engine modification kits for further in-service evaluation. Design of the new fan and turbine components will be continued for the derivative TF34 engine. The TF33 derivative program will continue with the design and component testing of increased efficiency component. The FY 1981 cost growth reflected in the FY 1982 Descriptive Summary is the result of a Congressional Addition for the F101 DFE. The budget increase in FY 1982 resulted from a FY 82 amendment submission which provided funds for the TF33 derivative program.

4. (U) FY 1983 Planned Program: The efforts initiated previously on the derivative T56, TF34, TF33 and F100 will be continued in FY 1983. The T56 derivative program will end during this year (first of the EMDP program to reach completion) with the successful completion of flight testing on a C-130 aircraft. Planning has been initiated to develop an aircraft modification program to incorporate the T56 derivative design changes (by retrofit kits) into the T56-A-7 and T56-A-15 engines. The F100 derivative engine will complete its accelerated mission testing during this fiscal year as will the flight test program on the F-15 and F-16 aircraft. Design of the new fan and turbine components will be completed for the TF34 derivative and component rig testing will be conducted.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64219F

DoD Mission Area: Counter Air, #221

Title: Integrated Digital Avionics
Budget Activity: Tactical Programs, #4

(U) RESOURCES: (Project Listing) (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimate Cost	Not Applicable
TOTAL FOR PROGRAM ELEMENT		2,500	0	2,100	4,300	Continuing		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: It is quite common for a newly developed avionics subsystem to fail to perform as expected when it is installed in an existing aircraft for the first time. In many cases this is due to a poorly specified or uncontrolled interface between the new subsystem and the existing avionics. The results are delays, cost increases, and an inability to interchange avionics between aircraft. In order to decrease development time and system costs, and increase the commonality of avionics subsystems across aircraft types, the Air Force has undertaken a major avionics standardization program. The central concept of this standardization program is that a limited number of essential interfaces can be defined as Military Standards. By testing and certifying new avionics as meeting these interface standards, the delays, cost increases and aircraft-to-aircraft incompatibilities can be avoided. The Integrated Digital Avionics program is the mechanism to develop and test interface certification tools and operate as an interface control agent or "Bureau of Standards" for both new avionics development programs and retrofit programs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Provides funds for development of hardware and software certification tools for MIL1750A 16-bit Computer Instruction Set Architecture, fabricate and test enhancements of the existing MIL-STD-1553B bus testor, and define requirements for certification and test of the aircraft side of MIL-STD-1760 (the aircraft-to-store electrical interface standard being developed under Program Element 63601F). Cost estimates are based on catalog prices for equipment and rejected unsolicited proposal prices for certification tool development.

(U) COMPARISON WITH FY 81 DESCRIPTIVE SUMMARY:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimate Costs	Not Applicable
RDT&E	2,500	1,000	2,000		Continuing		

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64219F
DoD Mission Area: Counter Air, #221

Title: Integrated Digital Avionics
Budget Activity: Tactical Programs, #4

(U) RESOURCES: (Project Listing) (\$ in thousands)

Project Number	Title	FY 1980				FY 1981				FY 1982				FY 1983				Total	
		Actual	Estimate	Estimate	Estimate	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Cost
		2,500	0			2,500	0			2,100	4,300			4,300				Not	Applicable
TOTAL FOR PROGRAM ELEMENT																			

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(U) COMPARISON WITH FY 81 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980				FY 1981				FY 1982				FY 1983				Total	
	Actual	Estimate	Estimate	Estimate	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Costs
	2,500	1,000			2,500	1,000			2,000				4,300				Not	Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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Program Element: #64219F

DoD Mission Area: Counter Air, #221

Title: Integrated Digital Avionics
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Between 1974 and 1980 under Program Element 63243F the Digital Avionics Information System program established that four main areas of avionics architecture would need some degree of standardization in order for the Air Force to take advantage of the revolution that was taking place in digital systems. These four areas were computers, software, multiplexed information transfer systems, and controls and displays. With the exception of controls and displays, successful standards have been developed and adopted in each area. The computer standard is the 16-bit instruction set architecture defined by MIL-STD-1750A, the software standard is the JOVIAL J73 higher order computer programming language defined by MIL-STD-1589B, and the multiplex system standard is that defined by MIL-STD-1553B. These three standards and the MIL-STD-1760 Aircraft-to-Stores Electrical Interface Standard define the baseline for avionics architectural standardization today. While it is nice to have standards, without a capability to test new systems and certify that they meet the standards, the Air Force derives almost no benefit. The Integrated Digital Avionics program is charged with developing the certification methods and tools for the computer standard (MIL-STD-1750A), the multiplex standard (MIL-STD-1553B), and the aircraft side of the aircraft-to-stores electrical interface standard (MIL-STD-1760). The software standard (MIL-STD-1589B) is maintained by the JOVIAL Control Facility under Program Element 64201F, Project 2560. Some tools and methods exist for certifying systems which implement the multiplex standard (MIL-STD-1553B). The case of the A-10 Inertial Navigation System is an excellent example of why certification is an essential capability for the Air Force. When the A-10 Inertial Navigation System was flight tested, the same manufacturer provided the control panel and the inertial platform assembly. These two boxes communicate over a MIL-STD-1553B multiplex bus. There were no problems with the multiplex bus during the flight test program, but testing revealed that the manufacturer's implementation of the multiplex bus deviated in several ways from MIL-STD-1553B. When a control panel from a second manufacturer was put in the aircraft, the system quit working. The Air Force was able to quickly determine which box was at fault and direct the manufacturer to correct the deficiencies. Without the certification testing, it would have been difficult and costly to retrofit a new control panel into the A-10 aircraft at a later date, or to add a new subsystem which conformed strictly to the interface standard. There are currently no certification procedures or testing tools for the computer standard instruction set (MIL-STD-1750A). This standard is the basis for reducing the proliferation of computers and support software; it is complex, and will be difficult to certify. The zero funding of Program Element 64219F in FY 81 has resulted in a one year delay in starting the development of the MIL-STD-1750A certification process. Since all new embedded avionics computers will be MIL-STD-1750A computers, there is a risk that without a certification capability, the Air Force will accept computers with undiscovered flaws.

(U) RELATED ACTIVITIES: The JOVIAL Language Control Facility is managed under Program Element 64201F Project 2560. Program Element 64201F Project 2257 performs assessments of potential benefits from developing standard hardware items or adopting existing subsystems as standard items. Project 2257 also funds initial development of standard hardware items from the time they are identified as being standard until they are funded as a separate Project. Standard computers and software are developed under Program Element 64201F Project 2297. New standards are developed in Program Element 63253F. All of these activities as well as Program Element 64219F are reviewed tri-annually by the Air Force standing panel on avionics standardization, and coordinated direction is issued for all programs from a single office within the Air Staff. To the extent that all new avionics systems will implement MIL-STD-1553B, MIL-STD-1750A and MIL-STD-1760 if applicable, they will utilize the certification tools and services being developed under Program Element 64219F.

(U) WORK PERFORMED BY: The work will be performed by a mix of inhouse personnel and under contracts managed by the Aeronautic Systems Division at Wright-Patterson Air Force Base, Ohio.

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Program Element: #64219F

DoD Mission Area: Counter Air, #221

Title: Integrated Digital Avionics
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Program Element 64219F was a FY 1980 new start. During 1980 funds were provided to continue the development and demonstration of the MIS-STD-1750 instruction set architecture as a way to achieve increased competition and decreased acquisition and support costs for embedded computers in weapon systems. Two vendors delivered brassboard versions of avionics computers conforming to the instruction set defined by MIL-STD-1750. These computers were shown to be interchangeable, even though they were not identical in design or implementation. In addition, efforts were begun to define a set of common data formats for the MIL-STD-1553B data bus, and two studies were completed which defined how to certify a computer as conforming to the MIL-STD-1750 instruction set architecture.
2. (U) FY 1981 Program: The Integrated Digital Avionics program was not funded in FY 1981.
3. (U) FY 1982 Planned Program: Certification tools and procedures for testing computers for MIL-STD-1750A compliance will be developed. A study will be performed to identify options for certifying the aircraft side of the MIL-STD-1760 Aircraft-to-Store Electrical Interface. Enhancements will be incorporated into the MIL-STD-1553B bus testor to reduce the manual operation of the set to a semi-automatic procedure.
4. (U) FY 1983 Planned Program: Certification tools will be available for the testing of new embedded computers for compliance with MIL-STD-1750A. All embedded computers will be required to pass this certification and test process prior to entering production and deployment. Development of the tools and procedures for certification of MIL-STD-1760 will be started. Manual procedures and the MIL-STD-1553B bus testor can be used for initial testing of MIL-STD-1760 compatibility. This will be required for systems such as Advanced Medium Range Air-to-Air Missile, and the Medium Range Air-to-Surface Missile.
5. (U) Program to Completion: As new avionics architectures and interface standards are developed and validated in 6.2 and 6.3 programs, the Integrated Digital Avionics program will monitor their developments to assure that a maximum of backward compatibility is maintained. When a new standard is applied to an engineering development program for the first time, the responsibility for testing and compliance certification will be transitioned to PE64219F. In this way the Air Force will maintain the capability to serve as its own "Bureau of Standards" for architectures and interfaces of the future.
6. (U) Milestones: Not Applicable.

(700)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64220F/27252F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: EF-111A

Budget Activity: Tactical Programs, #4

(U) RESOURCES: (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,150	5,550	14,500	19,200	25,200	219,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the Research, Development, Test and Evaluation (RDT&E) and integration of the ALQ-99E jamming subsystem into two F-111A aircraft. These aircraft are designated as EF-111A's and are equipped to perform dedicated tactical support jamming missions against surveillance, acquisition and ground control intercept radars. A phased production program tied to a suitability demonstration assessment was approved at Defense System Acquisition Review Council III. Satisfactory completion of the suitability demonstration provided the basis for a 26 March 1980 Office of the Secretary of Defense memorandum approving full production of a force of EF-111A aircraft to fill the current requirement for an Air Force tactical support jamming capability.

BASIS FOR FY 1982 RDT&E REQUEST: Funding is required to continue development and qualification of peculiar support equipment, to initiate enhancements to improve the EF-111A capability against capabilities and to fund development of an aircrew Operational Flight Simulator. Other tasks being accomplished, in cooperation with the Navy, include a cost trade-off study of a capability for the EF-111A and initiation of efforts RDT&E funding estimates were derived by the AFSC System Program Office.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E						
* Procurement (Aircraft)	7,000	10,500	5,100		8,000	178,000
	102,800	266,400	244,300		178,800	993,900
	105,500	272,500	264,300	202,700		1046,600
	(3)	(12)	(12)	(9)		
	1,094	1,760	2,500	4,239		6,739
	7,900	17,300	30,100	21,976	Continuing	163,800
				39,500	64,600	

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft)*
(Quantities)
Military Construction
Operation and Maintenance
Modification Installation

* Includes Initial Spares

Program Element: #64220F/27252F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: EF-111A

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Aircraft of the tactical forces are unable to counter the entire radar threat spectrum with on-board electronic countermeasures (ECM) subsystems due to space, weight, and power limitations. Onboard tactical ECM subsystems are primarily directed against the enemy's terminal weapon control radars. The mission of degrading surveillance, acquisition, and ground control intercept radars must be accomplished by tactical support jamming forces. Studies by the Department of Defense and United States Air Force concluded that the most effective means of providing the required jamming would be through integration of the ALQ-99 jamming subsystem with the F-111A aircraft. This combination meets the requirements without recourse to expensive and time consuming development of a new weapon system. This program also takes full advantage of experience gained with the existing Navy EA-6B system, incorporating improvements where they will be most effective. System improvements to counter threat radar advances will continue.

The purpose of this program is to develop, test and evaluate the EF-111A Tactical Jamming System to demonstrate the system's operational performance prior to a production decision and to maintain operational effectiveness throughout the systems service life. One inventory F-111A aircraft has been modified to incorporate updated ALQ-99 ECM subsystems including receivers, computers and ten high-power transmitters with directional/steerable antennas. Modified ALR-62 Terminal Threat Warning and ALQ-137 Self Protection Subsystems have been incorporated. Receiver antennas have been isolated from the transmitter antennas by locating them in a new vertical fin which incorporates an integral fairing for the equipment installation. The right-hand crew station is modified to incorporate necessary controls and displays. The existing F-111A Environmental Control System was replaced by the larger version from the F-111D to handle increased cooling requirements. Larger capacity F-14 electrical generators have also been added. A second inventory F-111A has been modified to the EF-111A form factor and used for the airworthiness certification and to certify the tail fin design. The Defense Systems Acquisition Review Council III Memorandum directed a phased production program tied to demonstration of operational suitability with deficiency corrections incorporated. Funding from within the existing program was necessary to accommodate immediate initiation of test effort. Development efforts, including software threat updates, support equipment development and initiation of aircrew simulator development was delayed/deferred to provide funding for deficiency corrections. The Secretary of Defense approval of full rate production was based on excellent test results where the EF-111A surpassed all thresholds and goals set for the test. Efforts to complete development of automatic test equipment have been reinitiated with only minor delays in completion. Threat update efforts and developments to enhance system effectiveness are planned to counter continuing technical advances in existing hostile radars and new radars introduced to hostile surface-to-air missile and command and control radars.

(U) RELATED ACTIVITY: The United States Navy developed the ALQ-99 Electronic Counter Measures (ECM) subsystem under Program Element (PE) 25674N EA-6B for installation in the EA-6B aircraft. Warning and Self Protection Equipment from PE 64738F, Protective Systems, are being used.

Program Element: #64220F/27252F

Title: EF-111A

DOD Mission Area: Electronic Warfare/Counter-C³, #257

Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright Patterson AF, OH, is responsible for management of the EF-111A program. The program was competitive. The winning bidder, and prime contractor is Grumman Aerospace Corporation, Bethpage, NY (airframe and electronics). Prime subcontractors are: Airborne Instruments Laboratory, Deer Park, Long Island, NY (ALQ-99 receiver); Raytheon Company, Goleta, CA (ALQ-99 Band 4-9 transmitters and excitors for all bands); Astronautics Corporation of America, Milwaukee, WI (displays); American Electronics Laboratories, Colmar, PA (ALQ-99 Band 1 and 2 transmitters); International Business Machines, Oswego, NY (Computer); Sanders Associates Inc, Nashua, NH (Self-Protection Subsystems); and Dalmo Victor, Belmont, CA (Threat Warning Subsystems).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The EF-111A program was first funded in late FY 1973. Procurement of long-lead electronic warfare equipment proposal solicitation, evaluation and award of dual design definition included 23 risk reduction analysis and brassboard equipment demonstrations. Dual design definition/risk reduction study contracts with the Grumman Aerospace Corporation and General Dynamics were completed in September 1974. Proposals for the two prototype development programs were evaluated and Grumman was selected. A Joint Operational and Technical Review and a Defense Systems Acquisition Review Council II review was conducted. Prototype phase tasks included electrical system design and modification, radome fabrication and installation, weapons bay reconfiguration, avionics vehicle equipment development, simulator evaluation, software design, and integration testing. Contractor Development, Test and Evaluation/Initial Operational Test and Evaluation was completed in April 1978. DSARC III met in December 1978 and, in February 1979, directed a phased production program with production of the first six aircraft tied to successful accomplishment of milestones associated with a suitability demonstration. Successful completion of this test, in which the EF-111A surpassed all directed goals and thresholds, culminated in a full rate production approval from The Office of the Secretary of Defense on 26 March 1980. First aircraft delivery is planned for July 1981. Production orders have been placed for the first 9 aircraft.

2. FY 1981 Program: The production program will continue in FY 1981 with the procurement of 12 additional modification kits, initial spares and support equipment peculiar to the EF-111A. The Aircrew Training Philosophy has changed to include a two place simulator due to considerations of the task loading transfer between the electronic warfare officer and the pilot, major cockpit changes, the unavailability of Federal Communication Commission clearances for equipment operation and the absence of training sites

Several RDT&E efforts were deferred during FY 1980 to accelerate deficiency corrections in support of the DSARC directed suitability demonstration. These include, software threat updates, completion of some peculiar support equipment and development of an aircrew training device. RDT&E funding is now required to complete those previously deferred efforts necessary in preparation for the first production deliveries. RDT&E funding is also required for completion of deficiency correction engineering and feasibility studies concerning advanced capabilities. Efforts to procure an interim crew training device were terminated as a result of the Congressionally directed program reduction of \$5.0M.

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Program Element: # 64220F/27252F

DOD Mission Area: Electronic Warfare/Counter-C3 #257

Title: EF-111A

Budget Activity: Tactical Programs, #4

3. FY 1982 Planned Program: The production program will continue in FY 1982 with procurement of 12 additional modification kits. RDTE funding is required to continue software threat updates, to develop an Operational Flight Trainer and to initiate development efforts necessary to ensure continued capability and effectiveness against

where expansion is feasible, cost effective and will provide a significant increase in defense suppression effectiveness without specifically duplicating other efforts. Tasks include a feasibility evaluation, continued from FY 1981, to determine the benefit of and the most cost effective approach (accomplished effectiveness against persistent Soviet threat system advances in the form of updates to existing systems and in conjunction with the Navy), expansion and enhancement of ALQ-99E jamming capabilities to cover additional where a high payoff in reduced attrition is expected (joint effort with the Navy) and preliminary investigation into installation of the proven AN/ALQ-153 Tail Warning System which is also being readied for installation into F/FB-111 aircraft.

4. (U) FY 1983 Planned Program: The final nine modification kits will be procured. Threat responsive software updates will be continued as will development of an Operational Flight Trainer.

5. (U) Program to Completion: Continue threat responsive software updates to existing equipment and complete development of an Operational Flight Trainer.

6. Milestones:

A. Phase 1B Contract Award	Jan 1975
B. Preliminary Design Completed	Nov 1975
C. Final Design Completed	Aug 1976
D. Avionics Equipment Development Completed	Oct 1976
E. Aircraft #1 (less Tactical Jamming (TJS) Systems avionics)	Feb 1977
F. Fabrication of Avionics Set Completed	Feb 1977
G. Aircraft #1 (less TJS avionics) First Flight	Mar 1977
H. Bench Avionics Integration Completed	May 1977
I. Simulator testing completed	Jun 1977
J. First Full-up Airborne Avionics Performance Test Complete	Jun 1977
K. Flight Test Evaluation completed	Apr 1978
L. Defense System Acquisition Review Council III	Dec 1978
M. DSARC III Memorandum	Feb 1979
N. Initiation of Phased Production/suitability evaluation	Mar 1980
O. Final Milestone/Full Production decision	Mar 1980
P. Begin development of communications jammer	Jun 1980
Q. Completion of support equipment development	Jun 1981

*(Sep 1980)

Program Element: # 64220P/27252P

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: EF-111A

Budget Activity: Tactical Programs, #4

6. Milestones: (Continued)

R. Deliver First Aircraft	(added)	Jul 1981
S. Initial Operational Capability (IOC) (18th Aircraft)	(added)	Nov 1983
T. Full Operational Capability (FOC)	(added)	Nov 1985

* Date presented in FY 1981 Descriptive Summary

Explanation of Milestone Changes: RDT&E efforts were reduced to minimum essential to support the Suitability Evaluation. Consequently several efforts, including support equipment development were delayed pending approval of the production program. Development of a system for the EF-111A was also delayed although it was initiated with considerably less funding.

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data: Development cost increases from \$178.0M to \$219.1M to continue software threat updates to accommodate funding requirements to develop an Operational Flight Trainer.

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	7,000	10,500	5,100		Continuing	Not Applicable
Procurement	102,800	266,400	244,300			

Budget Activity: Tactical Program, #4

Program Element: #27252F/64220F, EF-111A

Test and Evaluation Data

1. (U) Development, Test and Evaluation: The ground testing portion of the Development, Test and Evaluation was initiated by the development contractor, Grumman Aerospace Corporation, Bethpage, NY, in March 1975 to ensure subsystem and system integration performance for those development efforts directed by Defense System Acquisition Review Council III. This was accomplished prior to flight test to ensure that the new or modified subsystems met contractual specifications. Tests conducted at contractor/subcontractor co-facilities under laboratory/mockup conditions included the environmental control system, modified electrical power system, new antenna/radomes associated with new equipment, reliability, vibration, software support, support equipment and retained F-111A avionics systems. Air Force software support and fully developed support equipment was not available for this phase due to Defense Systems Acquisition Review Council II direction based on the cost associate with support equipment development and the need to verify EF-111A effectiveness prior to expenditure of funds associated with these areas. Peculiar ALQ-99E intermediate level and software support was provided by contractor personnel during Development, Test and Evaluation. This was a factor recognized as limiting the quality of information available for a later decision and resulted in continued testing after Defense, Systems Acquisition Review Council III. Specific test and evaluation capabilities built exclusively for the support of EF-111A Development, Test and Evaluation include a System Integration Test Station for software testing and total system integration and a crew station mockup for human factors evaluation of cockpit control and display adequacy and to evaluate operator procedure sequences. Government owned facilities that were used include the National Aeronautics and Space Administration wind tunnels (for aerodynamic loads and flutter tests), the Department of Defense Full Scale Anechoic Chamber (for electromagnetic interference and compatibility investigation), the Electronic Warfare Ground Simulators (for antenna pattern testing/optimization), the Rome Air Development Center EF-111A antenna pedestal (for antenna pattern testing/optimization), the Air Force Eglin Test Range and the Western Test Range (to evaluate ALQ-99E receiver and transmitter performance with previously established baselines). The Grumman Electronic Warfare Test Range was used to obtain broad-based engineering data. Government test facilities/ranges used during Development, Test and Evaluation did not differ significantly from those used during Initial Operational Test and Evaluation, although they did differ for later testing due to constant upgrade/modification of facility equipment. Airborne testing utilized two EF-111A prototype aircraft. Overall Development, Test and Evaluation air vehicle testing was performed from 10 March 1977 to 22 June 1977 using a prototype modified to the proposed structural configuration but without peculiar EF-111A avionics. Testing concluded that a tail fin redesign was necessary. This was accomplished later and resulted in a satisfactory evaluation. The second EF-111A prototype vehicle was used for contractor Development, Test and Evaluation system and subsystem tests between 17 May and 30 September 1977. This vehicle differed from the airworthiness vehicle in that all avionics subsystems were installed. System and subsystem components were identical to those intended for use in the production EF-111A except for the ALR-23 Infrared Warning Receiver which was present for testing but deleted in the production configuration. The configuration of other systems evaluated during Development, Test and Evaluation have been altered slightly from the original Development, Test and Evaluation configuration as a result of corrections of deficiencies identified during this and other phases of the flight test. Specific

Budget Activity: Tactical Program, #4
Program Element: #27252F/64220F, EF-111A

Test and Evaluation Data

components added to the modified F-111A airframe included the ALQ-99E Jammer Subsystem, the ALR-62 Terminal Threat Warning System, the ALQ-137 Self Protection System, a new Environmental Cooling System, revised aircrew station, and updated generators from the F-14.

2. Operational Test and Evaluation: The Initial Operational Test and Evaluation of the EF-111A Tactical Jamming System was conducted October 1977 - April 1978 by the Air Force Test and Evaluation Center. The EF-111A Initial Operational Test and Evaluation Final Report was published in August 1978. The aircraft was flight tested in the barrier/standoff and penetration/escort mission roles. The close air support and Battlefield Interdiction mission roles were evaluated at the Air Force Electronic Warfare Simulator. The following is a summary of the Initial Operational Test and Evaluation results and conclusions. The EF-111A's performance in the standoff/barrier role was determined to be excellent. The EF-111A's performance in the penetration/escort role supporting deep strikes was determined to be satisfactory to excellent. When supporting battlefield interdiction missions at the Air Force Electronic Warfare Evaluation Simulator, the EF-111A's performance was satisfactory. In addition to the EF-111A's jamming effectiveness, the Initial Operational Test and Evaluation included evaluation of the ALR-62, ALQ-137, human factors, aircraft performance, internal Electromagnetic Interference/Electromagnetic Compatibility, external Electromagnetic Interference/Electromagnetic Compatibility, and software. Results in each of these areas are: The performance of the ALR-62 was undetermined; the ALQ-137 performance was satisfactory; the single Electronic Warfare Officer concept was validated; The displays, controls, and cockpit configuration were determined to be satisfactory, however, some man-machine interface software improvements were recommended. Aircraft performance was satisfactory, Internal Electromagnetic Interference/Electromagnetic Compatibility was undetermined due to the ALR-62 not being in a configuration for testing. External Electromagnetic Interference/Electromagnetic Compatibility was minimal and determined to be satisfactory. The ALQ-99E and ALQ-137 software performance was satisfactory. Reliability was evaluated in two areas: Mission Completion Success Probability and hardware reliability. Mission Completion Success Probability was satisfactory. Peculiar subsystem reliability was satisfactory or projected to become satisfactory following identified reliability improvements. No significant degradation occurred in the systems common to the F-111A. Maintainability was evaluated in terms of Maintenance Man Hours per Flying Hour. The Maintenance Man Hour per Flying Hour values measured in a sterile test environment, using contractor support, were satisfactory;

Composite Model was used to estimate maintenance manpower requirements for the current and a mature system. They were satisfactory. Software supportability was determined to be deficient, but correctable to satisfactory. Due to the number and possible impact of deficiencies identified in Initial Operational Test and Evaluation, The Office of the Secretary of Defense directed the Air Force to complete a suitability demonstration to provide additional decision data. The additional operational testing of the EF-111A Tactical Jamming System was conducted as a Final Operational Test and Evaluation managed by Air Force Test and Evaluation Center. The primary purpose of the Final Operational Test and Evaluation, as directed in a 10 February 1979 Office of the Secretary of Defense memo to Secretary of the Air Force, was to evaluate system reliability and maintainability using Air Force maintenance personnel. Flight testing was initiated at Mountain Home Air Force Base during April 1979 and ended in October 1979.

Budget Activity: Tactical Program, #4
Program Element: #27252F/64220F, EF-111A

Test and Evaluation Data

Reliability data was collected during the entire test. Maintainability data was gathered from 1 June 1979 through 31 October 1979, as the period 18 April through 31 May 1979 was used for training Air Force maintenance personnel. Although the test was primarily designed as a suitability assessment, some effectiveness testing was conducted. Laboratory testing to compare the effectiveness of the ALQ-99E and the ALQ-137 in performing the self-protection role was conducted at the Air Force Electronic Warfare Evaluation Simulator. Similar testing with the ALQ-99E and ALQ-137 installed in the prototype EF-111A test aircraft was also conducted against radar simulators on the Nellis ranges. Flight testing was also conducted to evaluate the performance of the ALR-62 in an internal (ALQ-99E/ALQ-137) and external (F-4 aircraft with ALQ-119 self-protection electronic countermeasures pod) electronic countermeasure environment. Flight testing was completed on 14 November 1979. The Air Force Electronic Warfare Evaluation Simulator test incurred delays due to test system problems and testing was completed 9 May 1980. The Defense Systems Acquisition Review Council III memorandum established flight test goal of 150 flight test hours for the collection of Reliability and Maintainability data. Final flight test results were: 85 missions flown out of 89 scheduled; 261.4 flight test hours accumulated for reliability data; 197.6 flight test hours accumulated for maintainability data; A 5.0 hour Mean Flying Hours Between Failure was demonstrated for the ALQ-99E threshold was 3.0 hours; Mean Time To Repair for the ALQ-99E was measured at 3.1 hours. However, due to the high skill level of the test team maintenance personnel, a projection for a normal operational unit with some personnel in training status was made. The projection indicated the ALQ-99E Mean Time To Repair could be 4.4 hours (The threshold was 6.0 hours). The ALQ-137 experienced two failures in 121 flying hours for an Mean Flying Hours Between Failure of 60.5 hours, was evaluated as satisfactory even though no Final Operational Test and Evaluation threshold had been established. False Removal Rate of Line Replaceable Units resulting from Built-In-Test/Built-In-Test Equipment was 19.2 percent (The threshold was 25 percent) The measured Maintenance Man Hours per Flying Hour was 22.6. Since these results were obtained in a sterile test environment, a projection was made to estimate Maintenance Man Hour/Flying Hour for a mature system. This estimate was close to the current Maintenance Man Hours per Flying Hours of the F-111A, and satisfactory. Improvements to correct ALQ-99E software deficiencies discovered during Initial Operational Test and Evaluation were evaluated and determined to be satisfactory. Correction to the deficiencies discovered during Initial Operational Test and Evaluation, such as ALQ-99E Internal Electromagnetic Interference, ALQ-99E Band 4 transmitter reliability and ALQ-99E power interrupts, were evaluated and determined to be satisfactory. ALR-62 flight testing showed system operation to be considerably improved when compared to the system's performance during Initial Operational Test and Evaluation. The system experienced

was evaluated as satisfactory even though no Final Operational Test and Evaluation threshold was established. The test report was published in February 1980. Because all of the data from the Air Force Electronic Warfare Evaluation Simulator testing was not available at the time of publication, some of the Air Force Electronic Warfare Evaluation Simulator test results were published as an August 1980 addendum to the final report. Completion of Phase I Final Operational Test and Evaluation using production aircraft, is planned to be accomplished by Air Force Test and Evaluation Center between October 1981 and March 1982. This testing will be accomplished to confirm that deficiency corrections have

Budget Activity: Tactical Program, #4
Program Element: #27252F/64220F, EF-111A

Test and Evaluation Data

been installed in production aircraft and to further assess the operational suitability of the aircraft. Emphasis will be placed on evaluating equipment which had not previously been available for testing, such as the Intermediate Level Automatic Test Equipment.

3. System Characteristics: Significant EF-111A performance parameters with Decision Coordinating Paper threshold values shown below:

A.	<u>Characteristics</u>	<u>DCP Threshold</u>	<u>Achieved Values</u>	<u>Testing Accomplished During</u>	<u>By</u>
A.	Maximum sustained air speed at Sea Level (Mach Number)	.91	1.07	Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
				Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
	Unrefueled mission radius strike mission Mach 0.84 (Nautical Miles)	765	770	Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
B.	<u>ALQ-99E Jammer Subsystem</u>			Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
				Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
				Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
	Reliability			Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
	Mean Flying Hour Between Failure (hours)	3.0	5.0	Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
	Maintainability			Initial Operational Test and Evaluation	Air Force Test and Evaluation Command
	Mean Time To Repair, organizational level (hours)	6.0	3.0	Final Operation Test and Evaluation	Air Force Test and Evaluation Command
				Final Operation Test and Evaluation	Air Force Test and Evaluation Command

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64222F

DOD Mission Area: Defensive Theater Nuclear Warfare, #243

Title: Nuclear Weapon Support
Budget Activity: Tactical Program, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands):

PROJECT NUMBER	TITLE	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
5708	NUCLEAR WEAPON SUPPORT	1,100	1,580	1,700	2,100	CONTINUING	N/A
TOTAL FOR PROGRAM ELEMENT		1,100	1,580	1,700	2,100	CONTINUING	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides technical guidance to the Department of Energy, and direction to the North Atlantic Treaty Organization and Canadian Armed Forces to fulfill United States Air Force responsibilities related to the development and support of nuclear weapon systems. Supports Strategic Air Command required Operational Capability 16-71 (MX), 12-76 (Air Launched Cruise Missile), 6-76 (B61 Tactical Bomb), 6-69 (B83 Modern Strategic Bomb), and Tactical Air Force Statement of Need 304-77 (Ground Launched Cruise Missile).

(U) BASIS FOR FY 1982 RDT&E REQUESTS: Provides funds for salaries of the Air Force Weapons Laboratory cadre of civilian nuclear weapon specialists. Includes funds to perform all Air Force nuclear gravity weapon development programs. Funds other nuclear weapon support activities managed by the Air Force Weapons Laboratory's nuclear engineering system division. Cost estimates are developed by the Air Force Weapons Laboratory.

(U) COMPARISON WITH FY 81 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Cost
RDT&E	1,100	1,600	1,600		CONTINUING	N/A
Procurement	NOT APPLICABLE					

OTHER APPROPRIATION FUNDS:

Procurement *

- B83 Modern Strategic Bomb
- B61 Tactical Bomb
- Operations and Maintenance *
- B83 Modern Strategic Bomb
- B61 Tactical Bomb
- *Department of Energy Funded

Project: # 5708

Program Element: # 64222F

DOD Mission Area: Defensive Theater Nuclear Warfare, #243

Title: Nuclear Weapon Support
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Nuclear weapon development, modification, and life cycle support is a joint Department of Defense and Department of Energy program, in accordance with the Atomic Energy act of 1954. Air Force activities which support this dual agency program, as well as those which also fulfill unique Air Force responsibilities with respect to nuclear weapons are performed under the auspices of this program element.

(U) Nuclear weapon development responsibilities include acting as the Air Force technical manager during the development and modification of nuclear weapon assets. In the case of gravity bombs responsibilities include acting as the system program office during weapons development (B83, B61-3/4) and major modification (B61, B28).

(U) Nuclear weapon carrier/compatibility and equipment support programs include performing the system related technical safety evaluations required to nuclear certify new/modified Air Force weapon systems. Systems presently under study include the B-52 Offensive Avionics System/Air Launched Cruise Missile system, the F-16 fighter, and the North Atlantic Treaty Organization trilateral aircraft. Design responsibility for Air Force nuclear weapon loading and handling shapes, and for flight and load crew electronic simulators resides in this program element. Presently under development are the B83 loading and handling trainers, and the F-16 nuclear weapon store simulator. Nuclear weapon cargo tiedown testing in support of the Military Airlift Command for logistic nuclear weapon movements is also performed.

(U) Nuclear loading, delivery, and transport technical orders for all Air Force and North Atlantic Treaty Organization air delivered nuclear weapons are written, published, and maintained in this program element. Funds are provided by the Air Force Logistics Command, and Foreign Military Sales funds, on a cost reimbursable basis.

(U) RELATED ACTIVITIES: Activities which are related to the warhead development in this program element (PE) include PE 64312F (MX), PE 64361F (Air Launched Cruise Missile), PE 64362F (Ground Launched Cruise Missile), PE63318F (counter Soviet Union Airborne Warning and Control System), PE 63319F (Advanced Cruise Missile Technology). Activities related to nuclear weapon carrier modification/updating include PE 11113F (B-52 Offensive Avionics System), PE 11115F (FB-111B/C), PE 11118F (Short Range Attack Missile), PE 11213F (Minuteman Squadrons), and PE 11212F (TITAN Squadrons).

(U) WORK PERFORMED BY: Work is managed and primarily performed by the Air Force Weapons Laboratory, Kirtland AFB, N.M. The F-16 nuclear weapon store simulator and B83 loading and handling shape design package are being contractually procured from the Naval Weapons Facility, Dahlgren, Virginia. Flight testing in conjunction with the B83 and B61 programs is performed at the Air Force Flight Test Center, Edwards AFB, CA employing both Air Force Systems Command and Strategic Air Command aircraft assets. An Air Force Weapons Laboratory operating location at Ramstein Air Base, Federal Republic of Germany monitors all work on the trilateral Tornado aircraft.

Project: #5708

Program Element: #642222F

DOD Mission Area: Defensive Theater Nuclear Warfare, #243

Title: Nuclear Weapon Support

Budget Activity: Tactical Program, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Programs were initiated to develop nuclear warheads for cruise missiles (W80, W84), gravity bombs (B83, B61), and intercontinental ballistic missiles (MX, W78). Nuclear certification/compatibility support efforts for the F-16, B-52 Offensive Avionics System, and North Atlantic Treaty Organization trilateral aircraft, the Tornado, were initiated. On-going efforts supporting all stockpiled Air Force nuclear weapons continued. Nuclear weapon stockpile improvement efforts for the W25, B28, and B61 warheads were initiated.
2. (U) FY 1981 Program: Continued nuclear weapon development support. Engineering development is initiated for the MX warhead; upgraded W78 warhead is deployed on MM III missiles at Grand Forks AFB, ND, and Minot AFB, ND. B61-3/4 tactical bombs are deployed; the Air Launched Cruise Missile (W80 warhead) attains first alert capability at Griffiss AFB, NY. Engineering development of upgraded aircraft monitor and control units for the B-52 and FB-111 force is initiated.
3. (U) FY 1982 Planned Program: All nuclear weapon development support will continue. Air Launched Cruise Missile (W80) deployment will continue at Griffiss AFB, NY. B-52/cruise missile/short range attack missile nuclear certification support efforts will be completed.
4. (U) FY 1983 Planned Program: All nuclear weapon support activities continue. B-83 flight test program will be completed. Advanced weapon conceptual and feasibility studies (Department of Energy phase 1, 2 and 2A studies), and system specific technical nuclear surety analyses will be placed under the auspices of this program element. B83 and Ground Launched Cruise Missile first war reserve production occurs. First full squadron of B-52 aircraft equipped with the Air Launched Cruise Missile will become operational at Griffiss AFB, NY.
5. (U) Program to Completion: Not Applicable
6. (U) Milestones: Not Applicable
7. (U) Resources: Not Applicable

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(713)

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64231F
 DOD Mission Area: Airlift, #261

Title: C-X Program
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	0	34,600	252,000	375,100	TBD*	TBD*

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Airlift is required to project and sustain combat forces in a time urgent manner. Specific tasks associated with the airlift mission area include deployment, employment (airland, air-drop and extraction), sustaining support, retrograde, and combat redeployment. Additional airlift capability is needed for rapid intertheater deployment of combat forces to support national objectives and for timely intratheater movement to meet the forward area mobility requirements. The C-X program addresses that need. Airlift is vital to a NATO or Korean conflict as well as for the mobility requirements of a Rapid Deployment Force tailored to respond to worldwide contingencies.

(U) BASIS FOR FY 1982 RDT&E REQUEST: A major initiative to improve our rapid deployment capability is the development and production of the C-X, an aircraft capable of carrying outsized cargo over intercontinental distances into small, austere airfields. In addition, the C-X will provide the capability to move heavy mechanized Army equipment within the theater of operation. Several potential options are being considered in the C-X program. One is modification to existing designs, which offer the benefit of earliest availability. Another is the development of a new design which would offer the benefit of better adaptability to smaller, austere airfields. The FY 1982 request is to continue Full Scale Development on the C-X design selected during the Source Selection in July of 1981. Cost estimates are based on program office analysis and will be adjusted after contract award.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Procurement(Aircraft)	0	80,700	253,300		TBD	TBD
	0	0	152,610		TBD	TBD

(U) OTHER APPROPRIATION FUNDS:

Procurement(Aircraft)

172,900 TBD* TBD*

* To Be Determined upon completion of Source Selection .

Program Element: #64231F

DOD Mission Area: Airlift, #261

Title: C-X Program

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Protecting United States interests world-wide demands greater emphasis on airlift as a means of timely force projection. Airlift is vital to a NATO or Korean conflict as well as to a Rapid Deployment Force tailored to respond to worldwide contingencies. The Mission Element Need Statement for C-X has documented the need for additional airlift capability, especially in the area of outsized cargo. This program element provides a program to develop and produce a new airlift aircraft, the C-X.

The C-X program is a major initiative to improve our rapid deployment capability and also provide the lift capability to move heavy mechanized Army equipment in-theater. Several design options for the C-X are being considered. Modifying existing designs, such as the C-5 offers the benefit of earlier availability, while development of a new design offers the benefit of increased operational flexibility into smaller austere airfields. New designs may incorporate technology advances developed during the Advanced Medium STOL Transport such as composite structures, digital avionics and advanced flight control systems. These advances are being analyzed in upcoming commercial aircraft such as the 757 improve airlifter efficiency and productivity. The Air Force initiated source selection for the C-X program in the first half of FY 1981. The FY 1981 funding will initiate Full Scale Development on the selected C-X design after completion of source selection and a Milestone II review.

(U) RELATED ACTIVITIES: This program was a new start in FY 1981. The Air Force is also evaluating alternative means of relieving existing and projected shortfalls in bulk and oversized cargo. These alternatives would make available the type of airlift capability provided by commercial cargo aircraft. This evaluation is being conducted in parallel with the C-X program to insure a balanced overall airlift program.

(U) WORK PERFORMED BY: A Program Office is established in the Aeronautical Systems Division of Air Force Systems Command at Wright-Patterson Air Force Base, Dayton, OH. The Program Office, with participation from the Military Airlift Command and the Army, conducted the activities necessary for initiation of this new airlift program in FY 1981. The major contractors will be identified upon completion of source selection. The Air Force Flight Test Center and the Air Force Test and Evaluation Center will conduct developmental and operational flight testing in the Full Scale Development Program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.
2. (U) FY 1981 Program: Program Element #64231F, C-X Program, was a new start in FY 1981. After a Milestone II review, Full Scale Development will be started on the selected C-X design. Funds will be used for final configuration design system and component development, engineering design and design releases.

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Program Element: #64231F

DOD Mission Area: Airlift, #261

Title: C-X Program

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program: Wind tunnel aerodynamic evaluations will be conducted for final wing/nacelle interfacing Manufacturing and tooling planning will be integrated with production design effort. Subcontractor specifications will be issued and designs reviewed/evaluated. Planning for developmental and operational flight testing will be initiated. Changes from the FY 1981 Descriptive Summary are due to a delay in the initiation of the program and the moving of the Initial Operating Capability to FY 1987. Funding in FY 81 was reduced to \$34.6M from the \$81.3M Amended Budget request, although this change did not substantially reduce the Research and Development funding required in FY 82 it did delay the program sufficiently to shift the requirement for procurement funds to later years.
4. (U) FY 1983 Planned Program: Funds will be used for completion of design specifications on long lead procurement items, engine/airframe/avionics integration, production readiness and critical design reviews, detailed production design effort and fabrication of durability/static test articles. Funds will also be used for initiation of subsystem and component development, wind tunnel testing, initiation of flight simulator design, tooling and parts fabrication. Flight test and systems evaluation planning will be completed.
5. (U) Program to Completion: Funds will be used for completion of production design effort, assembly and test of durability/static test articles, completion of design specifications on procurement items and completion of support equipment design. Funds will also be used for completion of subsystem and component development and flight simulator testing, tooling and parts fabrication. Manufacturing assembly, flight test and systems evaluation will be completed on the Full Scale Development flight test articles.

6. (U) Milestones:

Complete Source Selection
Initiate Full Scale Development
Delivery of first production aircraft
Initial Operating Capability

3rd Qtr
4th Qtr

FY 1981
FY 1981
FY 1985
FY 1987

Budget Activity: Tactical Programs, #4
Program Element: 64231, C-X Program

Test and Evaluation Data

1. (U) Development Test and Evaluation: Combined Development Test and Evaluation and Initial Operational Test and Evaluation will be conducted by a combined test force on Full Scale Engineering Development flight test article of the selected C-X design. A Test and Evaluation Master Plan will be developed to identify the test organizational relationships and describe the testing to be accomplished during Full Scale Engineering Development The C-X Request for Proposal will require the offerors to describe in their proposal a test program that will flight qualify the aircraft and quantitatively establish the performance of the system. The Developmental Test and Evaluation and Initial Operational Test and Evaluation programs of the selected C-X design will be thoroughly examined at the Milestone II review. Initial airworthiness testing of the C-X will be conducted at Edwards Air Force Base, CA under the combined test force with the Air Force Flight Test Center taking the lead in the Development Test and Evaluation. Development tests will include stability, control and performance as well as testing of reliability, availability and maintainability.
2. (U) Operational Test and Evaluation: Initial Operational Test and Evaluation will be accomplished under a combined Developmental Test and Evaluation and Initial Operational Test and Evaluation test program. Air Force and Evaluation Center will take the lead in operational testing which will be conducted by a combined test team including the Air Force Flight Test Center, United States Army, and United States Marine Corps participation. The testing will consist of evaluations in the following areas: aircraft procedures and handling characteristics during preflight, engine start, pretaxi, and compatibility of any special procedures/techniques applicable to aircraft operations at high gross weights; aircraft potential to perform airdrop operations including heavy equipment, container delivery system, low altitude parachute extraction system, and personnel; flight characteristics during slow flight, cruise, high speed, low level, and airdrop configurations; formation characteristics required for inflight refueling; capability of the aircraft to operate at night and during a simulated instrument meteorological condition; suitability of the cargo compartment design to layout and field of view, crew and life support provisions, and workload functions; aircraft potential payload and range capabilities for deploying worldwide; aircraft reliability, maintainability, and logistics supportability. In addition, a period of dedicated operational testing will be conducted to assess operational suitability.
3. (U) Systems Characteristics: To be determined.
Reliability/Availability/Maintainability: To be specified in the Request For Proposal and addressed in the offeror's response.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64249F

Title: Night/Precision Attack
Budget Activity: Tactical Programs, #4

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	Total for Program Element	38,801 ^{1/2/}	63,228 ^{1/}	87,600	64,500	32,700	300,928
2693	Low Altitude Navigation and Targeting Infrared Systems for Night (LANTIRN)	37,000	58,800	87,600	64,500	32,700	296,100

- 1/ Work performed under Program Element 63249F, Night Attack Program--Project 2693 (LANTIRN) and Program Element 64613P.
- 2/ Reflects recent reprogramming of minus \$0.7 million.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) will provide a capability for low level precision attack during night and other than optimal weather conditions in air-to-surface interdiction and close air support missions. LANTIRN consists of navigation and targeting functions which will offer a strike capability against an enemy ground attack threat during day or nighttime operations. The LANTIRN capabilities will preclude the limited sanctuary that the enemy presently has at night and under the weather. The specific Air Force needs for an improved night air-to-surface attack capability are documented in the Air Force Planning Guide Mission Area Analysis, 1 December 1979.

(U) BASIS FOR FY 1982 RDT&E REQUEST

The Night/Precision Attack funding request will continue full-scale engineering development of the Low Altitude Navigation and Targeting Infrared System for Night which was initiated under Program Element #63249F, Night Attack Program. Critical design review will be conducted and F-16 integration will be initiated for the Low Altitude Navigation and Targeting Infrared System for Night. Development costs are based on contractor proposal and program office estimates for flight and qualification testing. Production costs are estimates based on contractor development contract.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,700	55,300	35,200		60,200	188,400
Procurement (Aircraft)		1,000	116,600		400,800	518,400
(Quantity)			(51)		(198)	(249)

Program Element: #64249F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Night/Precision Attack
Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
Pod Procurement (Aircraft)(PE 28031F)	1,000	15,900	0	0	0	16,900
(PE 27249F)	0	0	118,300	458,000	576,300	
(Quantity)			(34)	(266)	(300)	

Project: #2693

Program Element: #64249F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: LANTIRN

Title: Night/Precision Attack

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The threat by the enemy's formidable armored and air forces, especially of the Warsaw Pact against the North Atlantic Treaty Organization (NATO), has increased in the past few years and is projected to become stronger in both quantitative and qualitative terms. Enemy armor, equipped with night vision capability and accurate laser ranging systems, has been combined with new hardware, training and operational doctrine to assure a continued enemy thrust during night and adverse weather conditions. Successful interdiction and close air support missions against this projected threat require accurate target acquisition on weapons delivery. Even though target acquisition, laser designation and attack capability currently exist for day visual conditions, serious deficiencies occur when these same tasks are required to be performed during night and adverse weather conditions. The need is well documented in several sources including the Air Force Planning Guide, Mission Area Analysis, 1 Dec 1979; NATO Rationalization, Standardization, Inoperability (RSI) Master Plan, 5 Sep 1979; and Tactical Air Forces Statement of Need 302-79, Target Acquisition/Laser Designator for Single Seat Aircraft. This program is primarily dedicated to improving Air Force capability to conduct close air support and interdiction missions at night and in limited adverse weather for the F-16 and the A-10 on an immediate basis and is readily extendible to other ground attack aircraft in the inventory.

(U) RELATED ACTIVITIES: There are no other Air Force or other Service efforts to develop an advanced fire control pod or laser designator equipped Forward Looking Infrared (FLIR) pod for single seat aircraft. The current Navy F-18 pod has growth potential for a laser designator but is unsuitable for use on the F-16 for many reasons. There is no ongoing terrain following radar effort for the F16 or the A-10 other than that provided in the LANTIRN system. LANTIRN procurement will be accomplished in Program Element (PE) 27249F beginning in FY 1983. Development laser designator efforts are coordinated with the F-16, A-10 and Maverick Missile System program offices.

(U) WORK PERFORMED BY: All Air Force efforts will be managed by the Aeronautical System Division, Wright-Patterson AFB. Any F-16 efforts will necessarily involve the aircraft prime contractor, General Dynamics, Fort Worth, TX. Contractor for the Low Altitude Navigation and Targeting Infrared Systems for Night attack is Martin Marietta Corporation, Orlando, FL. The heads-up display for F-16 and A-10 which supports the LANTIRN system in the cockpit is contracted to Marconi Avionics Limited of the United Kingdom.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: After the initial budget request for increased night attack capability was denied in the FY 1979 Authorization Bill, the Air Force examined existing systems (F-18 Forward-Looking Infrared pod) as directed by Congress for possible adaptation to Air Force Use. FY 1980 Congressional action directed that \$12.5 million requested for Airborne Tracker Laser Illuminator System (ATLIS II) in Program Element 64613F, Common NATO munition be moved to the Night Attack Program. As a result of this action, FY 1979 funds totaling \$15.6M were transferred from Program Element 64613. A new program element, #64249F, was established for FY 1982 and beyond to provide the project greater visibility for prudent management. The Single Seat Laser Designator program was terminated in June 1980 as a consequence of FY 1981 Authorization Conference direction. A competitive source selection for developing the Low Altitude Navigation and Targeting Infrared System for Night was awarded September 1980 to Martin Marietta Corporation.

Project: #2693

Program Element: #64249F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: LANTIRN

Title: Night/Precision Attack

Budget Activity: Tactical Programs, #4

The Fire Control System is based on two pods: one pod incorporates a navigation FLIR and a manual terrain following radar; a second pod contains a slewable target acquisition FLIR and a laser designation system. A separate terrain following program to update the APG-66 radar on the F-16 was no longer required after source selection of the Low Altitude Navigation and Targeting Infrared System which will include a terrain following capability.

2. (U) FY 1981 Program: The prototype fire control pods and a wide field of view Heads-Up display will be designed and fabricated. Aircraft/pod/launcher integration and LAU-88 launcher modification will be initiated. Imaging Infrared Maverick missiles will be purchased for flight test and sensor correlation demonstration. A technical demonstration for the auto target recognizer and Forward Looking Infrared correlator will be conducted.

3. (U) FY 1982 Planned Program: Aircraft integration and pod fabrication will be continued. The target recognizer source selection will be conducted and concluded within the first quarter. Follow-on flight testing will be conducted in the contractor C-131 for the target recognizer and computer software. Development and operational flight testing will be initiated on the F-16. The Heads-Up Display design and integration testing will be completed. The development and operational flight test will be started for the F-16. Production Readiness will be initiated. The increase in FY 1982 RDT&E estimate as compared to the FY 1981 Descriptive Summary is a consequence of the change in procurement strategy transferring a greater portion of program risk from the government to the contractor. The corresponding decrease in FY 1982 procurement funding results from more realistic production scheduling based upon the firm negotiated contract issued in FY 1981.

4. (U) FY 1983 Planned Program: The ground integration will be completed and F-16 Heads-up-Display production will be initiated. Line replaceable unit deliveries of the target recognizer will begin. A-10 integration for flight test will begin. The combined Development/Operational Test and Evaluation will be completed for the F-16. As with the FY 1982 cost estimate changes, the FY 1983 adjustments from the previous Descriptive Summary result from awarding of the negotiated contract for the LANTIRN program.

5. (U) Program to Completion: Production of the Heads-Up display for A-10 will be accomplished from FY 1984 through FY 1986. Qualification testing on first production pods will include reliability and maintainability testing through FY 1985. Defense System Acquisition Review Committee (III) production decision scheduled for mid FY 1984.

6. (U) Milestones:

Begin flight test	Jun 1982
Heads-Up Display	Dec 1982
Pod	Oct 1983
Complete basic flight test	Jun 1984
Production Decision (DSARC III)	Jun 1985
First production pod	

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64268F

Title: Aircraft Engine Component Improvement Program (CIP)

DOD Mission Area: Air Warfare Support, #225

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	<u>TOTAL FOR PROGRAM ELEMENT</u>	<u>80,000</u>	<u>105,400</u>	<u>131,000</u>	<u>130,700</u>	<u>Continuing</u>	<u>Not Applicable</u>

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: Aircraft engine component improvement programs (CIP) are initiated after an engine/component has successfully completed all of the required development tests, meets the specification in the development contract, and the first production funded aircraft using the engine/component is accepted by the Air Force. Historically, systems add offensive/defensive equipment, have mission and/or tactics changes, and operate in different environments to meet the ever changing threats. It has been demonstrated that an active engine component improvement program is an effective means of reducing the cost of engine ownership, and improving system operational readiness through improvements in durability, maintainability, operability, reliability, reparability, and suitability of the engine as operational conditions change and service time is accumulated. System changes continue throughout the operational life of a system; therefore, the engine component improvement program must continue at a reasonable level to provide the engineering support required to obtain engine changes which are essential for satisfactory system performance in operational use at a cost affordable to the Air Force. The funds being requested represent the Air Force requirements only and do not include funds required from other Services or Foreign Military Sales on joint programs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: A CIP is required for each operational engine in order to be able to identify and resolve operational problems and potential cost avoidance that arise during service use. The CIP for each engine generally consists of the following types of efforts: (1) analytical and test efforts to identify the life limiting parts of an engine so that corrective actions can be initiated before operational use is impacted; (2) evaluation of new hardware for reducing adverse engine impact on the environment; (3) demonstrations to provide review/revision of maintainability actions to establish and update inspection limits and techniques for field and overhaul activities; (4) investigation of field and test failures to determine the significance and, where appropriate, generate changes on a timely basis to reduce the impact on the aircraft mission; (5) reduction of maintenance and spare parts costs through the development, evaluation, qualification, and introduction of repair techniques or redesigned parts; and (6) flight and ground tests on engines/components to provide immediate investigation of service-revealed discrepancies and to evaluate proposed engineering changes. Age, use, quantity of engines and operational experience are factors considered in determining the resource allocation to each of these efforts within a given engine CIP. A continuing program is conducted for each of the following engines/components to provide the efforts deemed necessary:

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Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

ENGINE MODELS	AIRCRAFT APPLICATION	FY 1982 (\$ IN MILLIONS)
TF41	A-7	8.67
TF34	A-10	20.50
J85-21	F-5	1.73
TF33	E-3A	2.06
J79	F-4	1.64
F100	F-15	18.52
F100	F-16	43.11
J57	KC-135	1.30
J75	F-105	1.10
J69	T-37	0.80
T56	C-130	1.93
J85	T-38	1.40
TF30	F-111	17.64
TF33	C-141	2.99
TF39	C-5	5.18
T58	HH-3	0.64
T64	HH-53	0.67
T400	UH-1N	0.57
GTU/T76	ALL/OV-10	0.55
	TOTAL	131.00

The level of funding for each engine program was derived from a bottoms-up estimate of development costs required to meet the specific engines program objectives and was reviewed by the Engine Advisory Group comprised of technical/management specialists from the Air Force Logistics Command, Air Force Wright Aeronautical Laboratories and Air Force Systems Command.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total	
						Estimated Costs	Not Applicable
RDT&E	80,000	105,500	107,600		Continuing		

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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557 724

Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Navy/Air Force/Army have found it necessary to maintain an engineering support capability for aircraft engines after the engine development period to address problems that occur over the operational lifetime of that engine. It is this effort that is referred to as the engine Component Improvement Program (CIP). Prior to FY 1980, this program was funded in Aircraft Procurement Appropriation, Budget Activity 7, Aircraft Support Equipment and Facilities. During the engine development program, attempts are made to satisfy all known engine requirements. These are in terms of performance, weight, durability, maintainability, reliability, and other specification requirements. It is also recognized that in the time normally available for engine development, most problems will be identified and solved. However, the limitations of ground testing and a comparatively short flight testing period will not uncover all possible operational difficulties. Experience has indicated that the engine will not achieve its final maturity level until after it has been in operational use for several years. It is during these subsequent years when many of the engine's problems are identified and solved.

(U) As the engine progresses through its life cycle, increased component failure or malfunctions, operational problems, and hardware condemnation will occur with increasing age and changing use. These service revealed problems must have timely corrective action through modification with redesigned components. Also there are instances where suppliers of new components or spare parts go out of business, discontinue manufacturing items for lack of production volume, change increasing prices for low quantity orders, or consolidate divisions within a parent company which entails relocation of tooling and training new people. Engineering surveillance and/or qualification testing of alternate or second source of parts is required to maintain a supply of needed components.

(U) The CIP is the vehicle by which engine problems are investigated and resolved. It is essential that such a program exists and operates for the engine to reach maturity and remain a useful power plant throughout its life cycle. Without timely engineering solutions of the service revealed problems, reduced operational readiness and increased maintenance overhaul costs will occur and thereby jeopardize the capability of the fleet to achieve its mission requirements.

(U) CIP is an engineering effort obtained from the original engine manufacturer and procured and managed by the Air Force or Navy, or jointly. The specific efforts undertaken are determined by the contracting agency (Air Force or Navy) after consideration of the development and operational experience, and the recommendations of all the engine users. In addition, the maturity and logistics goals established for the particular engine are used as program guidelines. Historically, during the early production periods the CIP effort concentrates on resolving early operational problems found with the engine and the redesign of engine parts to reduce the production cost. As the engine matures, greater emphasis is placed on engine component durability, maintainability, reliability through redesign of parts which limits engine use and the development of repair procedures to return used parts to a serviceable condition. The end result of the CIP is a better operational readiness of the engine, longer engine useful life, and lower acquisition and support costs.

Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: For requisite technology, this program draws on "core" engine technology (compressor, combustor, and high pressure turbine) from Program Element (PE) 63216F, Advanced Turbine Engine Gas Generator. Fan and low pressure turbine technology are provided by PE 63202F, Aircraft Propulsion Subsystem Integration. Materials processing and component fabrication demonstration come from PE 78011F, Manufacturing Technology Program. Additional component/engine test data is contributed by PE 64218F, Engine Model Derivative Program. The Navy has a supporting engine component improvement program.

(U) WORK PERFORMED BY: The overall program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. Individual engine component improvement programs are managed by the Aeronautical Systems Division, Deputy for Propulsion and the Air Force Logistics Command's San Antonio Air Logistics Center and Oklahoma City Air Logistics Center. In-house test and evaluation efforts are conducted at the Arnold Engineering Development Center, Tullahoma, TN and the Air Force Flight Test Center, Edwards AFB, CA. Contractors include Detroit Diesel Allison Division, Indianapolis, IN (T56, TF41 engines); General Electric Company, Evendale, OH (J79, TF39 engines); General Electric Company, Lynn, MA (J85, J85-21, TF34, T64, T58 engines); Air Research (Garrett) Phoenix, AZ (T76 and GPU); Pratt and Whitney Aircraft of Canada, Ltd (T400); Pratt and Whitney Aircraft, West Palm Beach, FL (J57, J75, F100, TF30, TF33 engines); Solar Division of International Harvester, (GTU); and Teledyne CAE, Toledo, OH (J69 engine).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This engine component improvement program was funded in the procurement appropriation in FY 1979 and prior and the R&D appropriations for FY 1980. Specific accomplishments include:

(U) F100 Engine:

- (1) Developed engineering changes which resulted in over \$2.0 billion cost avoidance.
- (2) Resolved major operational problems such as stall-stagnation.
- (3) Reduced in flight shutdowns from over 6 to less than 2 per 1000 engine flight hours.
- (4) Increased the maximum operating time for the various modules by a factor of 2 to 3.

(U) TF34 Engine:

- (1) Realized over \$12.5 million in production savings from CIP demonstrated improvements
- (2) Corrected the number 3 bearing problem.
- (3) Demonstrated fixes which have reduced the depot cost per flying hour from \$1,176 to \$305; and which have reduced the total cost per flight hour from \$5,762 to \$588.
- (4) One year's CIP effort resulted in production cost reduction of \$4,300 per engine and \$68 million in logistics cost avoidance.

Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

(U) TF30 Engine:

- (1) Demonstrated engineering improvements which resulted in excess of \$179.8 million in logistic cost avoidance.
- (2) Demonstrated a redesigned first stage turbine disc with a low cycle fatigue life of 6000 hours versus an original disc life of 1600 hours.
- (3) Redesigning the compressor to prevent rotor drum fixes which had resulted in two major aircraft accidents and one test cell incident.

(U) TF41 Engine:

- (1) Reduced unscheduled engine removals from about 8 to 3 per 1000 flight hours.
- (2) Redesigning the turbine blades to correct a safety of flight condition.
- (3) Identified the critical life limits on forty-one (41) cycle sensitive parts and conducted a risk assessment using service experience, test data, and finite element analysis techniques.
- (4) Redesigning the seventh stage high pressure compressor vane to adequately endure static and vibratory stresses.

(U) OTHER ENGINES:

The maximum operating time has been increased dramatically for all engines in the Component Improvement Program (CIP). In a recent five year span, engineering changes on the J57 resulted in over \$131.1 million in cost avoidance, and the TF33 has had over \$249.6 million in cost avoidance changes.

2. (U) FY 1981 Program: Although this program provides continuing engineering support for all engines and related hardware in the Air Force inventory, the major effort will be directed to the following programs:

- (U) F100 Engine: This program contains over 114 specific tasks which are intended to (1) reduce air aborts and Class A and Class B accidents; (2) reduce premature engine removals per 1000 engine flight hours by 15 percent on the F-15 engine; (3) reduce maintenance man hours per engine flight hour by 12 percent (4) achieve a 5% reduction in cost per engine flight hour. Major effort will be directed toward improving hot section durability through work on a shower head first stage blade, first to second stage spacer, and second stage turbine vane cooling. Efforts will be conducted to improve control system reliability/durability by obtaining better stepper motor reliability in the electronic engine control; (2) improve the wear resistance of the boost pistons in the unified fuel control; (3) increase rotor shaft strength and reduce shaft spline wear in the Main Fuel Pump; and (4) provide self test flag for the Events History Recorder and shock isolation to the Electronic Engine Control. Several tests are planned to improve augmentor/nozzle durability and to demonstrate fixes to extend module maximum operating hours. Many repairs (about 200 per year) are planned to reduce spare parts cost and increase the durability of engines.

Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

- (U) TF34: This program is structured to provide a cost effective engineering program to design, qualify and introduce hardware changes which will address the following goals: (1) reduce the percent of engines not mission capable by 17 percent; (2) reduce unscheduled removals per 1000 engine flight hours by 37 percent; (3) reduce scheduled removals per 1000 engine flight hours by 10 percent; (4) reduce maintenance manhours per engine flight hour by 44 percent; and (5) reduce depot and spares costs from per engine flight hour by 23 percent. Effort will also be directed toward the elimination of failure modes which impact safety of flight, and toward the improvement of operational readiness. The program includes a life management program which provides a means for predicting and tracking hardware low cycle and thermal cyclic life limits; design changes to engine accessories to reduce support costs and increase readiness; development and evaluation of component repair procedures to reduce the frequency of repair and replacement of major components. Extensive factory Accelerated Mission Testing (AMT) and component testing will be accomplished. A Damage Tolerance Program and special hot section work have been initiated.
- (U) TF30: The contractual engineering effort for this engine will cover the continued redesign/modification necessary to resolve flight safety failures, to evaluate and correct service revealed deficiencies, and to provide engineering design for developing and testing cost effective repairs for depot and field implementation. In addition, the TF30 Engine Improvement Program, AMT, and low cycle fatigue analysis/redesigns will be continued to identify and eliminate potential problems before fleet failure. Goals include: (1) reduce engine not mission capable from 25% to 17.4%, (2) reduce total engine removals per 1000 engine flight hours, by 3 percent, and (3) increase the average age of installed engines from 382 hours to 400 hours.
- (U) TF41: This program will continue to require engineering effort to resolve flight safety problems; to address service revealed deficiencies; and to assist logistics support with repair engineering, life cycle cost analysis and component life/risk assessments. Effort will continue on the combustion section to increase durability by redesigning: (1) a transpiration cooled combustor liner and dome assembly to reduce high temperature exposure by 250°F, and (2) a discharge nozzle utilizing a modified cooling pattern. Special attention will be given to the causes of compressor stalls. This will include: (1) removal of cadmium plating from the fuel wetted surfaces of the high pressure fuel pump (a current safety of flight problem), and (2) modification of the control system to prevent compressor stalls. Continuing efforts will be directed toward determining the low cycle fatigue lives of critical engine parts and increasing these lives. Major split line seals in the oil wetted sumps require design changes for resolution of major oil leaks which are one of the top ten reasons for unscheduled engine removals. These and other planned tasks should permit: (1) reduction in engine removals per 1000 engine flight hours by 24 percent, (2) reduction of maintenance manhour per engine flight hours by 4 percent, and (3) a 30% reduction in air aborts.

Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

(U) TF39: Engineering effort will be directed towards resolving service revealed problems and conducting fleet leader engine testing to provide early problem identification and correction as well as verifying fixes for the service revealed deficiencies. Major effort will be directed toward the development of repair procedures which will reduce the discarding of expensive parts. Titanium fires require fan/compressor modification and redesign effort is needed to reduce fan blade interlock wear. The CF6, a commercial derivative of the TF39, is accruing operating time at twice the rate of the TF39. Problems being experienced in the CF6 such as (1) wear of compressor blades, (2) stage 3-9 spool life, (3) stage 14-16 spool life, (4) stage 1 and 2 high pressure compressor blade tip rub, (5) stage 1 high pressure compressor vane life, (6) stage 2 high pressure compressor disc life, and (7) compressor rear frame cracking, will be evaluated and fixes developed where appropriate for the TF39.

(U) T56: The program will continue to address: (1) Safety of flight problems, (2) improvements in the capability to meet mission requirements, (3) reduce field maintenance manhours and costs, (4) reduce overhaul and spare parts costs, (5) reduce premature engine removals, and (6) develop repair procedures. Efforts planned include: (1) Series 1 rear turbine bearing, (2) improved 1st and 2nd stage turbine blades, (3) improved 1st stage turbine vanes, and (4) temperature datum valve improvements for better reliability.

(U) OTHER ENGINES: The programs for the other engines are directed toward the resolution of service revealed problems and development of repair procedures or work arounds to maintain logistic support for the engines. Limited testing is done to qualify fixes and repairs.

3. (U) FY 1982 and 1983 Planned Program:

a. (U) The Engine Component Improvement Program (CIP) is a continuous program carried on throughout the service life of the engines. Engineering effort will include the following general areas in conducting a CIP for each engine and related hardware.

- (1) Investigation, definition and correction of service revealed deficiencies.
- (2) Improve engine reliability and maintainability by improving on the design of marginal components.
- (3) Extend the maximum operating time of the engines.
- (4) Reduce overhaul cost by qualifying new wear limits and determining part life.
- (5) Maintain engine specification requirements.
- (6) Provide a review of maintainability actions, establish and update inspection limits and techniques for field and overhaul activities.
- (7) Provide early disclosure of any weakness that would limit engine life and would normally appear only after extended service operation.
- (8) Reduce maintenance and spare parts cost through the review, evaluation and introduction of repair techniques.
- (9) Initiate action to redesign and improve the marginal parts/components as soon as investigation and identification of potential weaknesses indicates such action is appropriate.

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Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)

Budget Activity: Tactical Programs, #4

b. (U) The general activity above applies to all engines in the Air Force inventory to one degree or another. The major efforts will be as follows:

(U) F100: Investigate and develop repair procedures; extensive testing to qualify repairs/redesigns and find potential problems ahead of fleet experience; work on 10 tasks contributing to Class A mishaps; reduce air aborts by approximately 0.2 per 1000 EEH; reduce maintenance manhour per engine flight hour by about 20 hours; reduce hardware cost per flight hour by developing a composite external nozzle flap, improving EHR reliability, improving the durability of the divergent flaps and several other items; and respond to UERs.

(U) TF34: Effort on this engine will be directed to identifying and resolving engine weaknesses before they occur in the field. This will involve extensive testing and analysis. Work will also be directed toward reduction of life cycle costs. Typical tasks are: fan blade FOD limit extension and repair; fan disk and blade life verification, long life combustor; redesign of #2HPT disk and outer liner redesign. Complete the Damage Tolerance effort and special hot section life extension. Investigation and resolution of service revealed deficiencies will also require significant effort.

(U) TF30: There will be testing effort to verify fixes resulting from the concentrated Engine Improvement Program and to continue extending the time on lead the fleet test engines. There are four models of the engine which forces more testing due to significant mission differences. There are impending flight safety failures which must be addressed as well as the redesign of rotating and static components with identified LCF life to provide cost effective and logistically manageable component life. Tasks such as 4th stage low pressure compressor disk life extension; low pressure turbine blade and vanes; first stage turbine blade baffle, first stage turbine vane durability and high pressure compressor disk will be worked. Effort will also be directed toward the identification and resolution of service revealed problems.

(U) TF41: Accelerated mission tests (AMT), accelerated cyclic turbine tests, engine performance tests, component lives and life cycle cost analysis will be conducted on many critical parts for analyzing their desirability for incorporation into production. The LP compressor sump and vane support assembly will be redesigned to alleviate excessive torsional, bending, and vibratory stresses with the vanes currently in service. Shroud wear and untwist limits within the LP turbine blades will be analyzed for their effect on excitation and life and appropriate correction action initiated. New repairs and reevaluation of serviceable limits will be necessary due to the fact the fleet is maturing and many engines are wearing beyond current serviceable limits.

(730)

Program Element: #64268F

DOD Mission Area: Air Warfare Support, #225

Title: Aircraft Engine Component Improvement Program (CIP)
Budget Activity: Tactical Programs, #4

(U) TF39: The major drive for this engine is to reduce support costs by providing repair procedures and redesign parts showing distress for any early removal of the engine. Some testing will be done to maintain a lead over the operational engines and to qualify repairs and redesigns. The maximum time between overhaul is being extended. It is anticipated that some parts will be unable to survive 5000 hours and will have to be redesigned to improve the cost avoidance potential for this change.

(U) T56: This program will concentrate primarily on the investigation, definition and correction of service revealed deficiencies preventing engines from achieving the full maximum time between overhaul and driving up the cost of logistic support. Effort will be directed toward actions necessary to maintain engine specification requirements as the engine ages and review maintainability actions to establish and/or update inspection limits and techniques for field and overhaul activities.

(U) OTHER ENGINES: The other engines in CIP are relatively mature and the effort on these programs is directed toward maintaining operational capability at reasonable logistic expense. As the engine ages new failure modes surface which must be addressed. Repair and maintenance procedures are continually reviewed and updated to meet the changing characteristics of the engines and their use.

c. (U) The cost increase between the FY 81 descriptive summary and the FY 82 descriptive summary was required to:

- (1) Provide for test cell fuel in FY 82.
- (2) Adjust for high inflation factors.
- (3) Increase test required to support the A-10 system requirement for increased operational life (6,000 to 8,000 hours) for the TF34 engine.
- (4) Increase support for the older operational engines.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources: Not Applicable.

8. (U) Comparison with FY 1981 Budget Data: In FY 1980, the Aircraft Engine Component Improvement Program (CIP) was submitted as a part of the Procurement Budget. Congress directed that CIP be transferred to the RDT&E budget and also reduced the FY 1980 funding from a request of \$104.4 million to \$80.0 million. This significant cut in the FY 1980 budget resulted in reduction in the engineering effort on all major engine programs and delayed the development and qualification of needed fixes. The FY 1981 request reflected the resources required to return the program to the level required to address critical engine problems. The FY 1982 request is consistent with the FY 1981 request with fuel costs, previously available from other accounts under the procurement budget, now reflected in the P.E.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64314F
DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
<u>TOTAL FOR PROGRAM ELEMENT</u>							
				141,900	163,500	118,800	424,200 <u>1/</u>

1/ Total estimated RDT&E funding for AMRAAM is \$579.1 million which includes Air Force Validation Phase funding under Program Element (PE) PE 63316F and PE 63370F (\$80.5 million) and Navy Validation Phase funding under PE 63370N (\$74.7 million).

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This joint Air Force/Navy program is structured in response to the Joint Service Operational Requirement and Mission Elements Need Statement to develop an AIM-7/SPARROW follow-on air superiority air-to-air missile with significant improvements in operational utility and combat effectiveness. A North Atlantic Treaty Organization (NATO) Staff Target titled "Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond" has identified a similar requirement. The need described is for an adverse weather, all aspect, all environment air-to-air missile compatible with the F-14, F-15, F-16, F-18 and appropriate NATO air superiority and air defense aircraft. The missile must have a performance envelope significantly improved over the AIM-7F/M, increased missile velocity, a "launch and maneuver" employment capability, and the capacity for multiple target attack during a single intercept. AMRAAM will satisfy these needs. AMRAAM Full Scale Development is funded under this program element.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funding for one of the two competing Validation Phase contractors to initiate engineering design and development of AMRAAM and fabricate of missiles that will be tested during FSD. The request includes funds to introduce a follower contractor into the program to become knowledgeable of the leader's system and accomplish production planning to permit him to compete sooner for production buys. Cost estimates are based on in-house and independent cost estimates performed by and for the AMRAAM Joint System Program Office.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RD&E	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E						305,400 <u>1/</u>

1/ An FY 1981 Descriptive Summary was not prepared for PE 64314F. However, total estimated FSD costs were annotated in the Descriptive Summary for PE 63370F.

Program Element: #64314F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This joint Air Force/Navy program has the overall objective of continued improvement of United States and North Atlantic Treaty Organization (NATO) air-to-air combat effectiveness. The Joint Air-to-Air Missile Requirements Study was initiated by the Under Secretary of Defense for Research and Engineering in October 1975. Combat deficiencies identified in South East Asia and the resultant improvements incorporated in the AIM-7F were reviewed to form the baseline for near and far term requirements definition. The study group reviewed the current and projected airborne threat spectrum, the Air Force/Navy roles and their relative priorities, and current technologies. The Joint Air-to-Air Missile Requirements Study findings were documented in a Joint Service Operational Requirement which was validated in September 1978. This Joint Service Operational Requirement and the Mission Element Need Statement, approved by the Secretary of Defense in January 1979, provide the basis for the Advanced Medium Range Air-to-Air Missile (AMRAAM) development effort. The threat spectrum for which AMRAAM is optimized includes: manned aircraft (fighters, bombers, fighter-bombers and interceptors) operating from
Mach with maneuvering accelerations up to
feet and speeds up to Mach
altitudes up to
feet and speeds up to Mach
The projected aircraft threat includes: improved capability for
air-to-air missiles.

(U) In August 1980, the United States signed a Memorandum of Understanding with the United Kingdom, Germany and France concerning a Cooperative Program for a Family of Air-to-Air Missile Systems. The Memorandum of Understanding calls for the European participants to develop the next short range missile and the United States to develop AMRAAM to satisfy the medium range missile requirement in the North Atlantic Treaty Organization Staff Target.

(U) The Advanced Medium Range Air-to-Air Missile development effort has the objective of significantly increasing United States and NATO air-to-air capability and operational utility in the 1980s and beyond by producing a more effective, reliable, affordable, maintainable missile, with emphasis on low altitude targets in an electronic countermeasures environment. To satisfy the Mission Element Need Statement, Joint Service Operational Requirement, and North Atlantic Treaty Organization Staff Target, the proposed Advanced Medium Range Air-to-Air Missile design utilizes inertial mid-course guidance and an active radar terminal guidance approach. Key features which will improve operational utility include: high average missile velocity, more range than AIM-7/SPARROW, increased maneuverability, multiple target attack, and launch and leave capabilities. Mature technologies, such as solid state electronics, high rate digital computers, and terminal guidance-aided fuzing are featured in the contractor approaches. Of prime importance is the requirement for the Advanced Medium Range Air-to-Air Missile to be totally compatible with the fire/weapons control systems of the F-14, F-15, F-16, F-18 and appropriate NATO air superiority and air defense aircraft. The Validation Phase effort began in 1979 with the selection of two competitive contractors to fabricate and test components and then fabricate total prototype systems for live missile firings. Rail launchers will be developed to provide the necessary aircraft/miss interfaces and will be capable of AMRAAM and AIM-9/SIDEWINDER carriage. Ejection launchers will be modified SPARROW launchers or new launchers developed for the Advanced Medium Range Air-to-Air Missile so as to maintain a SPARROW launch capability.

Program Element: #64314F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)

Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The Advanced Medium Range Air-to-Air Missile development program is a Joint Service effort with the Air Force as Executive Service and Navy personnel integrated into the Joint System Program Office. The Navy has assigned to the Joint System Program Office the Deputy Program Manager, the Assistant Chief Engineer and various other assistants for logistics, budget, project management, and test. The Joint System Program Office is maintaining a close relationship with the F-14, F-15, F-16 and F-18 program offices to assure that proper consideration is given to the aircraft modifications that will be required. Other programs related to the full employment capability of AMRAAM include target identification and improved aircraft radar target processing techniques. In the Advanced Medium Range Air-to-Air Missile Decision Coordinating Paper issued after Milestone I, the Office of the Secretary Defense directed that an Operational Utility Evaluation be conducted concurrent with Validation and Full Scale Development. The Operational Utility Evaluation was to include simulation, analysis and flight tests necessary to establish the operational utility of AMRAAM as well as the cost and effectiveness benefits of AMRAAM compared to alternative systems. An Operational Utility Evaluation man-in-the-loop simulation and analysis effort is underway to establish the utility of AMRAAM by comparing the effectiveness of AMRAAM and AIM-7M with and without reliable identification systems and using single and multi-target track avionics in a realistic environment. Due to the avionics implications, the Operational Utility Evaluation was initiated under Program Element 64201F (Aircraft Avionics Equipment Development). However, with the addition of funds in fiscal year 1982 and fiscal year 1983 for expanding a range and procurement of long lead items to preserve an option to conduct an Operational Utility Evaluation flight simulation if one is required, the Operational Utility Evaluation effort exceeds the scope of Program Element 64201F. Beginning with fiscal year 1982, funding for the Operational Utility Evaluation and range upgrade is in Program Element 28008F, Operational Utility Evaluation of the Advanced Medium Range Air-to-Air Missile and Program Element 78019F, Utah Test and Training Range, respectively. The AMRAAM Validation Phase, which ends in early fiscal year 1982, is funded under Program Elements 63370F and 63370N. Funding for Navy peculiar Full Scale Development requirements will be included in Program Element 64314N. Procurement of AMRAAM will be funded under Program Element 27163F beginning in fiscal year 1984.

(U) WORK PERFORMED BY: The Advanced Medium Range Air-to-Air Missile development and acquisition program is being managed by the Advanced Medium Range Air-to-Air Missile Joint System Program Office at the Armament Division, Eglin Air Force Base, FL. In addition to the Armament Division, other government organizations/facilities participating in the development effort include White Sands Missile Range, NM; Air Force Avionics Laboratory, Wright-Patterson Air Force Base, OH; Air Force Materials Laboratory, Wright-Patterson Air Force Base, OH; Pacific Missile Test Center, Naval Air Station Pt Mugu, CA; and Naval Weapons Center, China Lake, CA. One of the two competing Validation Phase contractors, Hughes Aircraft Company, Canoga Park, CA and Raytheon Company, Bedford, MA, will be selected to continue with full scale development of AMRAAM.

Program Element: #64314P

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: During the first quarter of fiscal year 1977, the Advanced Medium Range Air-to-Air Missile design definition was initiated based upon the Joint Service Operational Requirement as directed by the Under Secretary of Defense for Research and Engineering with funding provided by Congress. Design efforts included performance optimization, cost trade-offs, the beginning of laboratory testing and scintillation/miss distance reduction demonstrations at the White Sands Missile Range facilities. Design proposals were prepared in anticipation of the beginning of the Validation Phase in fiscal year 1978. However, the fiscal year 1978 budget did not include funding for the initiation of the Validation Phase. In July 1978 Congress approved a reprogramming request of \$7.0 million from the Air Force and \$6.0 million from the Navy for a continuation of the competitive design definition effort that included component development and evaluation; system performance/cost/effectiveness evaluations; aircraft fire control/radar interface investigations; evaluation of the missile's capability in an electronic countermeasures and clustered target environment; and continued analysis of surface-to-air and long range applications of AMRAAM Initiation of AMRAAM Validation Phase was approved at Milestone I in November 1978 and documented in the Advanced Medium Range Air-to-Air Missile Decision Coordinating Paper in January 1979. Thirty-three month Validation Phase contracts were awarded to Hughes Aircraft Company and Raytheon Company in February 1979. Primary efforts during fiscal year 1979 included missile subsystem and system level design, development and test; AMRAAM launcher design and development; and initiation of the P-15 Class II modification design, development, and test continued through fiscal year 1980. Rail and ejection launchers were delivered, the Class II modification to the P-15 was completed and the P-16 Class II modification was nearing completion. Sixty-one captive carry seeker test missions were completed. Seekers from both contractors began testing in electronic countermeasures and clustered target environment in a detailed hardware-in-the-loop seeker simulation develop at the Army Missile Command, Huntsville, AL. Other simulations were also under preparation to evaluate the missiles' flight performance.

2. (U) FY 1981 PROGRAM: Design, development, and fabrication of prototype AMRAAMs will continue under Program Elements 63370F and 63370N. Extensive hardware-in-the-loop simulation testing will continue to evaluate the performance of each contractor's prototype missile. Class II modifications for the P-14 and P-16 will be completed in preparation for the prototype flight tests. The two competing AMRAAM contractors will deliver prototype AMRAAM controlled test vehicles and guided test vehicles for testing. The controlled test vehicles will be fired to demonstrate safe separation from the launch aircraft. Subsequently, each contractor's guided prototypes will be fired under ten different launch conditions specified by the Government. Initial planning called for each contractor to deliver for test an additional six prototype AMRAAMs to be fired under launch conditions specified by the contractors. Additional data that would have been collected during the contractor development flights will be collected during the more than 100 captive carry flights for each contractor. In lieu of these contractor development flights, each contractor will accomplish additional seeker development work and demonstrate the seeker that will be included in his full scale development missile. Test data from all areas of evaluation will be compiled, reduced, and analyzed. Results will be formalized in support of presentations leading to Milestone II. Planning and actions for timely transition into the Full Scale Development Phase will be implemented.

Program Element: #64314F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 PLANNED PROGRAM: Flight testing of the prototype AMRAAMs will be completed in early fiscal year 1982 under Program Elements 63370F and 63370N. The results of the Validation Phase efforts will be presented at Milestone II in November 1981. The results of the prototype testing and the contractors proposals for Full Scale Development (FSD) and initial procurement options will be evaluated to select one of the contractors to continue the development of AMRAAM. A 40-month FSD effort will be initiated under this Program Element (64314F). Engineering design and development will begin with the design to be firm by the end of fiscal year 1982. The contractor will begin fabrication and delivery of development missile subsystems for test. Various types of ground tests will be conducted. Modification of the F-14, F-15 and F-16 aircraft to be used during Development Test and Evaluation/Initial Operational Test and Evaluation will be initiated. Hardware-in-the-loop missile simulations will be used to assess the contractors AMRAAM design. A leader/follower concept will be employed. The follower contractor will be introduced to become knowledgeable of the leader's system, accomplish production planning, and perform schedule risk reduction. This effort will allow the follower to contribute more effectively and compete sooner as a second source in production buys subsequent to the initial buy.

4. (U) FY 1983 PLANNED PROGRAM: Modification of the F-14, F-15, and F-16 for the FSD test program will continue. The prime contractor will begin delivery of missiles and launchers for test. Ground testing will continue with numerous captive carry flights scheduled. The first guided test vehicle firing is planned for late in the fiscal year.

5. PROGRAM TO COMPLETION: AMRAAM FSD will continue. Extensive Development Test and Evaluation/Initial Operational Test and Evaluation will be conducted with Milestone III planned for FY 1985. Initial procurement funding for AMRAAM will be in FY 1984 under Program Element 27163F. First production delivery is planned for late FY 1985 with the initial operational capability for a planned for FY . The increased total cost to complete Full C Scale Development results from the incorporation of production type tooling during FSD, increased complexity of the FSD design requiring more producibility efforts, the addition of a follower contractor during FSD and changes in the model used to estimate the FSD costs.

6. (U) MILESTONES:

- A. Start Design Definition
- B. Complete Design Definition
- C. Start Pre-prototype Evaluations
- D. Complete Pre-prototype Evaluations
- E. Milestone I
- F. Award Validation Phase Contracts
- G. Subsystem Test Start
- H. Flight Tests Start
- I. Subsystem Test End
- J. Flight Tests End
- K. Award Full Scale Development Contract
- L. Milestone II

October 1976
May 1977
July 1978
September 1978
November 1978
February 1979
March 1979
October 1980
October 1981
October 1981
November 1981
November 1981

737

Program Element: #64314F

DOD Mission Area: Counter Air, #221

Title: Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

- M. Full Scale Development Subsystem Tests Start
- N. Full Scale Development Flight Tests Start
- O. Full Scale Development Flight Tests End
- P. Full Scale Development Subsystem Tests End
- Q. Milestone III
- R. First Production Delivery

May 1982
April 1983
January 1985
February 1985
March 1985
September 1985

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Budget Activity: Tactical Programs, #4

Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

Test and Evaluation Data:

1. (U) Development Test and Evaluation: The Advanced Medium Range Air-to-Air Missile program was initiated as a joint Air Force/Navy development effort (Air Force lead service) to develop and produce a lightweight, active radar guided missile for use on the F-14, F-15, F-16, and F-18. With the signing of the Memorandum of Understanding for a Family of Air-to-Air Missile Systems, AMRAAM will be compatible also with the German F-4F and British Tornado. The Mission Element Need Statement and Joint Service Operational Requirement call for improved effectiveness (high velocity, launch and leave, multiple-target attack), operational utility (short range operational launch without airborne intercept radar), reliability, maintainability and affordability. Beginning with full scale development, AMRAAM must address the requirements in the Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond. Development of AMRAAM is being managed by the AMRAAM Joint System Program Office at Eglin AFB, Florida.

(U) Following the completion of concept definition and Milestone I (November 1978), contracts were awarded to Hughes and Raytheon, 2 February 1979, for the 33-month competitive Validation Phase. Milestone II is planned for November 1981. A 40-month Full Scale Development effort will be conducted prior to Milestone III in March 1985. Combined Development Test and Evaluation/Initial Operational Test and Evaluation is planned for the Validation and Full Scale Development phases. In addition, a separate phase of Initial Operational Test and Evaluation is planned near the end of Full Scale Development. The AMRAAM Joint Test Team is the Development Test and Evaluation test agency with Air Force Test and Evaluation Center the Operational Test and Evaluation test agency.

(U) The test and evaluation portion of the program was initiated early in fiscal year 1980 with the start of captive carriage testing of the seekers. One contractor's prototype AMRAAM has been separated successfully from an F-15. Prototype guided missiles for each contractor will be fired beginning in early fiscal year 1981 and ending in late fiscal year 1981 prior to Milestone II. The prototype systems tested during this phase are anticipated to be similar to the engineering development configuration missiles to be tested early in Full Scale Development. Test objectives are to examine the potential of each contractor's prototype AMRAAM to meet Joint Service Operational Requirements and be produced economically. The prototype missile firings are planned for White Sands Missile Range, New Mexico and Pacific Missile Test Center, California.

(U) Following contractor-conducted Development Test and Evaluation early in Full Scale Development, joint Air Force/Navy Development Test and Evaluation will begin late in fiscal year 1983 and continue through early fiscal year 1985. Full Scale Development testing will be conducted using pre-production missiles and proposed support equipment. The major objectives of development test and evaluation are to:

a. (U) Provide sufficient testing to determine equipment readiness for independent Operational Test and Evaluation. Areas that will be addressed include performance, compatibility, interoperability, reliability, maintainability and logistical supportability.

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Budget Activity: Tactical Programs, #4

Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

b. (U) Determine if the system meets contract specification requirements and identify technical deficiencies so that changes can be instituted before the start of production.

c. (U) Demonstrate compatibility of the ejector launcher with the AIM-7 and the rail launcher with the AIM-9.

(U) Although a firm schedule for Full Scale Development testing has not been prepared, Development Test and Evaluation will include extensive laboratory, captive flight and live firing tests. The tests will include electronic countermeasures testing, logistic support/ground support evaluations and simulated operational environments where ship suitability, electromagnetic interference and aircraft catapult/arrestment will be evaluated.

2. (U) Operational Test and Evaluation: No Advanced Medium Range Air-to-Air Missile (AMRAAM) Operational Test and Evaluation has been accomplished to date. Combined Development Test and Evaluation/Initial Operational Test and Evaluation is planned during the Demonstration and Validation Phase and Full Scale Development. In addition, a separate phase of Initial Operational Test and Evaluation will be conducted at the end of Full Scale Development. Air Force is lead service with the Air Force Test and Evaluation Center as Operational Test and Evaluation test agency.

(U) Demonstration and Validation Phase. Operational Test and Evaluation conducted during this phase will consist of monitoring Development Test and Evaluation tests. The missiles to be tested will be functionally but not mechanically similar to production items. Air Force Test and Evaluation Center will prepare an independent report on the projected operational effectiveness and suitability of both systems tested. Demonstration and validation testing will be conducted during fiscal year 1981.

(U) Full Scale Development Phase. Initial Operational Test and Evaluation will be combined with Development Test and Evaluation, where possible, when the AMRAAM configuration is representative of production missiles. A separate phase of Initial Operational Test and Evaluation will be conducted near the end of Full Scale Development using pilot production missiles. Data collected during both the combined and separate phases of Initial Operational Test and Evaluation will be used to provide a valid estimate of the Advanced Medium Range Air-to-Air Missile's operational effectiveness and suitability to support Milestone III. Full Scale Development testing will be conducted from late fiscal year 1983 through early fiscal year 1985.

(U) Air Force Test and Evaluation Center will have the overall management responsibility for Advanced Medium Range Air-to-Air Missile Initial Operational Test and Evaluation. The United States Navy Operational Test and Evaluation Force will ensure that Navy requirements are included in the Initial Operational Test and Evaluation test plan.

(U) While specific test locations have not been determined, ranges with the capability (with modification) to test the Advanced Medium Range Air-to-Air Missile are:

- (1) White Sands Missile Range, New Mexico.
- (2) Eglin Gulf Test Range, Florida.

Budget Activity: Tactical Programs, #4

Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

- (3) Pacific Missile Test Center Range, California.
- (4) Naval Weapons Center Test Range, California.

(U) Only preliminary Advanced Medium Range Air-to-Air Missile Initial Operational Test and Evaluation planning has been accomplished to date. The combined Development Test and Evaluation/Initial Operational Test and Evaluation program will consist of approximately 58 total missile firings from the F-14, F-15, F-16 and F-18 aircraft. During the last six months of the combined testing, a concurrent but separate Initial Operational Test and Evaluation test phase is planned which will include firing 29 pilot production missiles from the F-16 and a 2800 hour captive-carry reliability program using another 20 pilot production missiles. The planned testing will provide data for a production decision of the Advanced Medium Range Air-to-Air Missile.

(U) Decision Coordinating Paper 174, 13 January 1979, levied an additional requirement on the services to perform an Advanced Medium Range Air-to-Air Missile operational utility evaluation. The operational utility evaluation is to consist of analyses, air combat simulation, and flight tests required to establish the operational utility of AMRAAM. In May 1979, the Air Force Test and Evaluation Center contracted with McDonnell Douglas for the conduct of the air combat simulation. The simulators are being prepared for tests beginning in mid-fiscal year 1981. Based on the results of the simulation and analyses conducted prior to Milestone II, the need for and scope of an operational utility evaluation flight test will be determined. The budget contains funds to expand the Utah Test and Training Range and procure long-lead items to preserve the option to conduct the flight test portion concurrent with Full Scale Development. This utility evaluation is an operational test and is funded under Program Elements 28008F, AMRAAM Operational Utility Evaluation, and 78019F, Utah Test and Training Range.

(U) Air Force and Navy personnel will operate the Advanced Medium Range Air-to-Air Missile throughout the development program. Contractor personnel will maintain the Advanced Medium Range Air-to-Air Missile during Validation and Demonstration and the beginning of Full Scale Development. Thereafter, all equipment will be maintained by Air Force and Navy personnel.

3. Systems Characteristics: The missile is being defined in response to the Mission Element Need Statement and the Joint Service Operational Requirement and the Operational Objective for NATO Air-to-Air Missiles for the 1980s and Beyond. The objectives data listed below are tentative and reflect Joint Service Operational Requirement specifics which will continue to be subjected to cost/performance trade-offs.

TEST AND EVALUATION DATA:

A. Performance

Speed, Maximum Mach
Altitude, Feet
Maximum

Objectives

Demonstrated

To be demonstrated

To be demonstrated

Budget Activity: Tactical Programs, #4

Program Element: 64314F/63370F - Advanced Medium Range Air-to-Air Missile (AMRAAM)

Minimum Range:		To be demonstrated
Maximum Nautical Miles		To be demonstrated
Minimum, Feet		To be demonstrated
Accuracy, Circular Error Probable		To be demonstrated
Kill Probability, Percent		<u>Demonstrated</u>
B. <u>Reliability</u>		
Mean Flight Hours Between Failure	450-600	To be demonstrated
Free Flight	.8-.85	To be demonstrated
C. <u>Missile Description</u>		
Launch Weight (pounds)	200-350	To be demonstrated
Warhead Weight (pounds)	25-50	To be demonstrated
Guidance Type	Active radar terminal/inertial midcourse	
Compatibility	F-14, F-15, F-16, F-18, F-4F (German), Tornado (British)	

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64321F

DOD Mission Area: Tactical Command and Control, #254

Title: Joint Tactical Fusion Program
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,788 *	5,500	10,000	8,700	24,100	68,400
2758	Automated Tactical Fusion Division (ATFD)	4,788	5,500	10,000	8,700	24,100	68,400

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces have a critical need to rapidly (on a near real time basis) exploit time-sensitive and high volume, multi-sensor information. The objective of this program is to develop and field an Automated Tactical Fusion Division (ATFD) which will correlate and aggregate multi-source sensor data; provide precise location of opposing force structures or nodes; and provide ground battle situation displays to support the Tactical Air Control Centers.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to support Congressional redirection of the Battlefield Exploitation and Target Acquisition (BETA) and Tactical Fusion Division (TFD) Projects to combine with related Army projects and form the Joint Tactical Fusion Program. The Air Force configuration of the system developed in this joint effort will be the ATFD. The cost estimate was developed by the Air Force Systems Command program office with assistance from the BETA Joint Project Office.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:**

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E TOTAL FOR PROGRAM ELEMENT	4,490	5,500	7,500		17,200	45,840
PROCUREMENT (OTHER)					25,000	25,000

(U) OTHER APPROPRIATION FUNDS:**

PROCUREMENT (OTHER)	14,200	2	14,200	2
(Quantity)				

* These funds were included in PE #27431F under Projects 2517 (BETA) and 2576 (TFD).

** Procurement (Other) funds are included in PE 27431F and are identified here for reference only.

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Program Element: #64321F

DOD Mission Area: Tactical Command and Control, #254

Title: Joint Tactical Fusion Program

Title: Automated Tactical Fusion Division

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The employment of highly mobile and technologically advanced weapon systems by opposing tactical military forces require early detection, identification and location. To support this requirement, sophisticated sensor systems which can detect and locate basic elements (such as electronic emitters) are being increasingly employed. There is a critical need to rapidly exploit this time-sensitive and high volume of sensor information. The purpose of this program is to develop and field an Automated Tactical Fusion Division (ATFD) which will correlate and aggregate the large number of elements (such as multi-channel radios and radars) detected by various sensor systems and reduce them to force structures (such as command posts and air defense batteries); provide ground battle situation displays; and provide target nomination support to the Tactical Air Control Centers. The Services have submitted the Joint Tactical Fusion Development and Acquisition Program Plan to the Office of the Secretary of Defense based on Congressional redirection of the Battlefield Exploitation and Target Acquisition (BETA), Tactical Fusion Division (TFD) and All Source Analysis System (ASAS) Projects to combine and form a joint acquisition effort, now called the Joint Tactical Fusion Program. The plan describes a program to acquire fusion systems for the Services at the earliest possible date (1985) through a joint effort to maximize the use of common hardware and ensure interoperability within and among Services. Where appropriate, the joint acquisition effort will make maximum use of the investments in the BETA Project by incorporating BETA software and technologies into the development of the joint fusion system. This is in consonance with the Air Force commitment to using the BETA Project's design and software to the maximum extent possible for early fielding of an operational system. The Air Force configuration of the jointly developed system will be known as the ATFD. The Joint Tactical Fusion Development and Acquisition Program Plan will be the basis for a program development plan and an acquisition strategy with the Army as the lead Service. The approved funding identified in this Descriptive Summary below the funding required in the Joint Tactical Fusion Development and Acquisition Program Plan. Consequently, planned programs and milestones beginning in Fiscal Year 1981 and beyond cannot be specifically addressed in this Descriptive Summary and are subject to change as the Joint Tactical Fusion Program's requirements and approved funding are revised.

(U) RELATED ACTIVITIES: Related Service activities will be combined and redefined upon implementation of the Joint Tactical Fusion Program. These activities include BETA, TFD, ASAS, Signal Intelligence Electronic Warfare Subsystem and Technical Control and Analysis Center Projects.

(U) WORK PERFORMED BY: The Executive Agent for the Battlefield Exploitation and Target Acquisition Joint Project is the Army. The Joint Project Office (JPO), manned by personnel from all Services and the National Security Agency, is located at the Harry Diamond Laboratories, Adelphi, MD. Its Air Force Integration Division is located at Hanscom Air Force Base, MA. This Division is responsible for the Air Force peculiar development of the BETA Test Bed and for the TFD Project. The Chief of the Division is also the Air Force Project Manager for the TFD Project. All Air Force manpower currently authorized for BETA JPO (including authorizations at Hanscom AFB) will be transferred to and collocated with the Joint Tactical Fusion Program Office. The Army is the lead Service for this new joint program. TRW, Redondo Beach, California, is the prime contractor for the BETA Test Bed development.

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Program Element: #64321F

DOD Mission Area: Tactical Command and Control, #254

Title: Joint Tactical Fusion Program

Title: Automated Tactical Fusion Division

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A Tactical Fusion Division study was initiated and completed in FY 1977. A Battlefield Exploitation and Target Acquisition (BETA) Project Request for Proposal was released to industry in November 1977. Prime contract was awarded in February 1978 to TRW for the development of the BETA Test Bed. Modifications required on interfacing sensor subsystems were determined. Communication support plans were prepared and a Critical Design Review was conducted in February 1979. Plans for the modification to sensor subsystems and communication support equipment were accomplished. Test Bed efforts concentrated on developing sufficient capability to participate in a September 1980 European Demonstration. Subsystems to interface the sensors with the Test Bed were developed and installed. Development of the communication subsystem and support equipment was completed. In June 1980, the European Demonstration was cancelled and current project funds were used to complete the software development and correct Test Bed deficiencies. These efforts were accomplished under Projects 2517 and 2576, Program Element #27431F.
2. (U) FY 1981 Program: All efforts and funding will be directed towards a joint Service development and acquisition of a militarized fusion system for earliest possible fielding. The FY 1981 effort will focus on performing systems engineering/integration functions, generating the Statement of Work and specifications and preparation of the Requests for Proposals for the militarized terminals, hardware for the correlation centers, continuing software development, and continuing development of the simulation program to drive the fusion system during testing and operational exercises. Service operational testing on the Test Bed is planned to refine requirements for the operational system.
3. (U) FY 1982 Planned Program: The request for proposal to develop the three sets of militarized terminals will be released and the contract will be awarded before the end of the year. An upgraded configuration will be available for use on the Test Bed for operational testing during Reforger 82. Funding was increased from \$7.5 million to \$10.0 million to support OSD direction to continue the Joint Fusion Development Project beyond FY 1981.
4. (U) FY 1983 Planned Program: Contract to develop three militarized production prototype hardware sets of the correlation center will be awarded during the year. Development of the terminals will continue. An upgraded configuration of the collateral software and high level sensor message load simulator will be available for use with the Test Bed in a command post exercise in the continental United States.
5. (U) Program to Completion: Development of the militarized production prototype hardware will continue. Acquisition of the long-lead items for the follow-on limited production run will be initiated. The continuing software development effort will yield an upgraded software configuration which will be implemented on the Test Bed and utilized for a field training exercise in Europe. Three production prototype hardware sets will be delivered and a combined Development Test and Evaluation and an Operational Test and Evaluation will be conducted over a one-year period. System will be fielded at Shaw and Bergstrom Air Force Bases (9th and 12th Tactical Intelligence Squadrons). OSD direction to continue the Joint Fusion Development Project beyond FY 1981 required an increase in the RDT&E funds and reduced the production funds included under the ATFD by having the BETA Project complete the development of and upgrade and acquire the software.

Program Element: #64321P

DOD Mission Area: Tactical Command and Control, #254

Title: Joint Tactical Fusion Program
Title: Automated Tactical Fusion Division
Budget Activity: Tactical Programs, #4

6. (U) Milestones:

	<u>Date</u>
A. Award Prime Contract	Feb 78
B. Critical Design Review	Feb 79
C. Multi-Center Demonstration	Sep 79
D. Congressional Redirection of Program	Jun 80
E. Command Post Exercise	Jul 80
F. Joint Tactical Fusion Plan Submitted to OSD*	Oct 80

* Future milestones cannot be specifically identified in this Descriptive Summary and are subject to change - see Detailed Background for more information.

Budget Activity: Tactical Programs #4

Program Element: #64321F Joint Tactical Fusion Program

Project: 2758, Automated Tactical Fusion Division

TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation: The Battlefield Exploitation and Target Acquisition Project was established to design and develop a testbed primarily in support of Army and Air Force tactical command centers. The project was to demonstrate and evaluate the feasibility and utility of correlating inputs from multiple tactical battlefield sensors and national sensors to produce ground situation displays and target nominations in near-real time for improved battle management. The Battlefield Exploitation and Target Acquisition testbed is a joint Army/Air Force project with the Army as lead service; during Congressional review of the project for Fiscal Year 1981, it was directed the Battlefield Exploitation and Target Acquisition Project, Automated Tactical Fusion Division, and the Army's All Source Analysis System be combined into a Joint Tactical Fusion System development after the Office of the Secretary of Defense approval of the program plan. Based on approval of the plan, Development Test and Evaluation will begin in Fiscal Year 1985.

(U) The Automated Tactical Fusion Division, Project 2576, is the planned Air Force follow-on engineering development of the Battlefield Exploitation and Target Acquisition Testbed. The Automated Tactical Fusion Division, Battlefield Exploitation and Target Acquisition, and the Army's All Source Analysis System will be combined into a Joint Tactical Fusion System development after the Office of the Secretary of Defense approval of the program plan. Based on approval of the plan, Development test and evaluation will begin in Fiscal Year 1985.

2. (U) Operational Test and Evaluation: The Battlefield Exploitation and Target Acquisition Testbed will be used for demonstration and validation of the fusion concepts for the follow-on Air Force Automated Tactical Fusion Division and Army All Source Analysis System developments. During the planned 1981-1982 continental United States (Hurlburt Field, FL) and European demonstrations of the Battlefield Exploitation and Target Acquisition equipment, the Air Force Test and Evaluation Center will perform a preliminary operational assessment, focusing on those capabilities which are intended for the Automated Tactical Fusion Division. The United States Army also plans to perform an All Source Analysis System oriented operational assessment of the Battlefield Exploitation and Target Acquisition Testbed during the same time frame.

(U) When the preproduction Automated Tactical Fusion Division and All Source Analysis System equipments (engineering development models) are delivered in Fiscal Year 1985, a combined development test and evaluation/initial operational test and evaluation will be conducted in the continental United States. The United States Army Operational Test and Evaluation Agency will lead the Initial Operational Test and Evaluation effort with Air Force Test and Evaluation Center performing an Initial Operational Test and Evaluation of the Air Force-unique portion, focusing on the Automated Tactical Fusion Division equipments. The Initial Operational Test and Evaluation will address both the operational effectiveness and operational suitability of the Automated Tactical Fusion Division and All Source Analysis System prototypes. Major Initial Operational Test and Evaluation objectives will include assessments of the sensor interface software performance, enhancements to the sensor coordination, intelligence correlation, situational awareness, target nomination, and battle management functions. In addition, the communications implications and human factors associated with the Automated Tactical Fusion division and All Source Analysis System will be assessed.

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Budget Activity: Tactical Programs #4

Program Element: #64321F Joint Tactical Fusion Program

Project: 2758, Automated Tactical Fusion Division

(U) The United States Air Forces Tactical Air Warfare Center will be the Tactical Air Forces lead agency for user participation in the testing with other elements of the Tactical Air Command and United States Forces in Europe providing resources. Elements of the Air Force Electronics Security Command and Air Force Logistics Command are also expected to participate in the testing. The objective of the Automated Tactical Fusion Division is to achieve an initial operational capability by the mid-1980s with two systems based in the continental United States. Significant test milestones are not currently available, but will be included in the recently developed Joint Tactical Fusion Program Plan to be submitted by the Office of the Secretary of Defense to Congress.

3. (U) Systems Characteristics: The Battlefield Exploitation and Target Acquisition Testbed is a tool that will be used to develop and validate operational concepts and procedures. Specific products will be the Air Force Automated Tactical Fusion Division and the Army All Source Analysis System that will be developed based on the Battlefield Exploitation and Target Acquisition Testbed and related technology. The Battlefield Exploitation and Target Acquisition Testbed employs Joint Interoperable Tactical Command and Control System data messages and will provide early evaluation of these standards in an automated environment. Battlefield Exploitation and Target Acquisition will provide the Department of Defense with a single joint testbed for correlation and fusion of ground target sensor information.

(U) Automated Tactical Fusion Division currently planned performance and objectives are:

<u>Performance</u>	<u>Objective</u>	<u>Demonstrated</u>
Number of Sensors Inputting	15	To be tested in Fiscal Year 1985
Sensor Report Rates	250 reports per hour/sensor	
Full Situation Display Generation	10 seconds	
Cross Correlation Display	3 seconds	
Self Correlation of Reports	3 seconds	
Graphics Portrayal Transmission Between Centers	Plus or minus 15 seconds of one minute	

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64362F

DOD Mission Area: Theater-Wide TNW, #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	59,500	107,618	80,367	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of the Ground Launched Cruise Missile (GLCM) is to counter modernization of Soviet long-range theater nuclear forces, particularly SS-20s and Backfire bombers. The need is for a system capable of surviving a Soviet first strike and having enough range to reach targets in the western military districts of the Soviet Union, thus helping to deter a combined Warsaw Pact and Soviet numerical superiority in both conventional and theater nuclear forces. This program element provides for full scale engineering development to adapt the TOMAHAWK cruise missile into a tactical mobile ground launched system.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Continue engineering development which began in 1978. Specific development efforts are cruise missile integration, the launch canister, transporter erector launcher, the launch control center, and weapon control system software. Major milestones during this period include delivery of the first test system to the Air Force and start of developmental and initial operational test and evaluation. The TOMAHAWK missile development, funded under the Navy's Sea Launched Cruise Missile Research and Development appropriation, supports the Ground Launched Cruise Missile system development. The FY 1981 RDT&E estimate was developed by the Joint Cruise Missile Project Office with some assistance from contractors.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	59,500	67,500	30,600		8,200	220,100

(U) OTHER APPROPRIATION FUNDS:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
Missile Procurement (Quantity)	8.2	164.1 (11)	351.8 (54)	TBD (120)	TBD (375)	TBD (560)
Military Construction		22.2	74.5	TBD	TBD	TBD
Department of Energy costs						

Program Element: #64362F

DOD Mission Area: Theater-Wide TWW, #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Ground Launched Cruise Missile is an adaptation of the TOMAHAWK cruise missile as a ground mobile weapon system to increase theater firepower. Faced with numerical increases and advanced technology of enemy forces, a cost effective weapon is required to sustain theater capability. Ground Launched Cruise Missile can satisfy this need for a system with a high single-shot probability of destruction of tactical targets and with coverage of a large percentage of the theater target system. The Ground Launched Cruise Missile, with a nuclear warhead, preprogrammed targeting, and a quick reaction, all weather capability can provide increased firepower and improve the non-nuclear force levels by releasing quick reaction alert aircraft for other than nuclear tasking. In effect, this provides increased conventional firepower without additional aircraft.

Technology developed in the TOMAHAWK advanced development program supports the development of a Ground Launched Cruise Missile weapon system capable of 2500 kilometers operational range and terminal accuracy of less than Circular Error Probable. Pre-launch survivability is enhanced through system mobility which allows dispersal from main operating bases to random locations during periods of increased tension or actual hostility. Because of the missile's range, the weapon system can be located well behind the Forward Edge of the Battle Area, further complicating the enemy's prelaunch attack problem.

(U) The Ground Launched Cruise Missile program will integrate the TOMAHAWK cruise missile into an air transportable, ground mobile unit. The missiles are transported four to a launch platform and are controlled by a launch control center. Four transporters with sixteen missiles and two launch control centers constitute a flight. The design of the launch control center, transporter erector launcher, and associated electronics comprise the bulk of the program. System integration and testing make up the balance of the effort. The weapons control system software development is the pacing item in the development program.

(U) RELATED ACTIVITIES: The Ground Launched Cruise Missile as a weapon system is a new development, but it will incorporate technologies previously developed in command, communication, and control subsystems and carrier vehicles. Program Elements 64367N, TOMAHAWK and 64361F, Air Launched Cruise Missile are closely related.

(U) WORK PERFORMED BY: The Joint Cruise Missiles Project Office located in Washington, D.C. has overall responsibility for the Ground Launched Cruise Missile development and testing. The January 1977 Cruise Missile Defense System Acquisition Review Council II direction established the Joint Cruise Missiles Project Office with the Navy as lead Service to manage current cruise missile development with special emphasis placed on commonality between programs. The Air Force Ground Launched Cruise Missiles Project Office is staffed by the Air Force within the overall auspices of the Director, Joint Cruise Missiles Project Office who is the Program Manager. Air Force Systems Command, Andrews AFB, MD and Aeronautical Systems Division, Wright Patterson AFB, OH interface and support this development activity. Air Force Test and Evaluation Center, Kirtland AFB, NM will be responsible for operational testing. The Utah Test and Training Range has been selected as the Ground Launched Cruise Missile

Program Element: #64362F

DOD Mission Area: Theater-Wide TNW #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

primary test site. General Dynamics, San Diego, CA is contractor for the TOMAHAWK missile airframe. McDonnell Douglas, St Louis, MO is the navigation/guidance contractor. Williams Research, Walled Lake, MI is the contractor for the engine. General Dynamics is the weapon system integration contractor. GTE Sylvania is the communications subcontractor. Vitro, Silver Spring, MD is the weapon control system software and integrating contractor with McDonnell Douglas, St Louis, MO providing the hardware.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Subsystem development continued. Highlights were critical design reviews of the transporter erector launcher, the launch control center, and communications suite. Detailed design of subsystems and integration of these subsystems into a total weapon system began. An engineering test unit of the transporter erector launcher was completed and used in the first contractor test flight in May 1980. Preparation started for the Air Force combined Developmental Test and Evaluation/Initial Operational Test and Evaluation which is scheduled to begin in fiscal year 1982. Production tooling startup for the production line and long lead items for the FY 81 buy were funded during this period.
2. (U) FY 1981 Program: System development will continue with critical design reviews on the weapon control system and the trailer for the transporter erector launcher and launch control center. Fabrication of preproduction articles will occur to support the Air Force test and evaluation. Planned test assets include nine missiles and their canisters, four transporter erector launchers, and three launch control centers. Guidance sets, engines, and warhead flight test articles also begin delivery in support of the test program. The production of eleven missiles, six transporter erector launchers, and six launch control centers, and associated support equipment will be funded to meet the planned December 1983 Initial Operational Capability.
3. (U) FY 1982 Planned Program: Contractor ground qualification tests and two flights occur followed by the start of Air Force test and evaluation. There is a continued development of the weapon control system software and weapon system support equipment. Definition of the Integrated Logistics Support for the Ground Launched Cruise Missile begins. Fifty-four missiles, nineteen transporter erector launchers, eleven launch control centers, and associated support equipment will be funded in fiscal year 1982 in order to meet the planned force structure buildup. The FY 1982 funding estimate is an agreed upon position between Headquarters Air Force Systems Command and the Joint Cruise Missile Project Office, a special joint estimating team co-chaired by Air Force Systems Command and the Project Office, and the latest contractor proposals for full scale development of the weapon system. The increase in the funding estimate from fiscal year 1981 to 1982 is due to the refinement and reestimating of development costs.
4. (U) FY 1983 Planned Program: Development of the Integrated Logistics Support program continues along with development of the training program. The Air Force test and evaluation program and system ground qualification tests are planned to be completed in January 1983 which lead to a Defense System Acquisition Review Council III scheduled for May 1983. Procurement funding will be used to buy one hundred and twenty missiles, twenty-eight transporter launchers, and fourteen launch control centers.

Program Element: #64362P

DOD Mission Area: Theater-Wide TNW, #242

Title: Ground Launched Cruise Missile
Budget Activity: Tactical Programs, #4

5. (U) Program to Completion: Follow-on Operational Test and Evaluation will be accomplished and will primarily consist of continued testing to complete residual test objectives not accomplished during Air Force test and evaluation. Deficiencies and areas of concern surfaced during prior testing will be reexamined and corrected. An analysis of operational effectiveness and suitability of the Ground Launched Cruise Missile weapon system will continue. System deployment will continue into fiscal year 1988, with procurement of another three hundred and seventy-five missiles, eighty-two transporter erector launchers, and forty-six launch control centers.

6. (U) Milestones:

A. DSARC II	CY Date
B. Program Initiation	Jan 1977
C. First Full Scale Engineering Development Flight	Oct 1977
D. Critical Design Review	May 1980
E. First Test Article Delivered	*(Apr 1980)
F. Complete Development/Initial Operational Test & Evaluation	*(Apr 1980)
G. DSARC III	*(Feb 1981)
H. Initial Operational Capability (IOC)	*(May 1982)
	*(Jun 1982)
	Jan 1983
	May 1983
	Dec 1983

* Date presented in FY 1981 Descriptive Summaries

(U) EXPLANATION OF MILESTONE CHANGES: The milestone changes were caused by delayed development of the weapon control system software and associated slip in the planned test schedule. The changes were internal program changes (slip the weapon control system critical design review, delay system test six months, and move DSARC III) and do not change the IOC.

Budget Activity: Ground Launched Cruise Missile
Program Element: 64362F

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Ground Launched Cruise Missile Test program is being managed by the Joint Cruise Missiles Program Office. General Dynamics is the prime integrating contractor and the Air Force Flight Test Center is the development test agency. Ground Launched Cruise Missile development testing of the TOMAHAWK missile will incorporate test results from the Sea Launched and Air Launched Cruise Missile programs to reduce GLCM test requirements. Applicable areas include engine performance qualification, airframe, navigator/guidance, and missile performance.
- (U) First contractor test launch of a TOMAHAWK missile from an engineering test unit of the Transporter Erector Launcher occurred 16 May 1980 at Dugway Proving Ground, Utah.
- (U) Full system testing will begin November 1981 using preproduction prototype missiles, Transporter Erector Launcher and Launch Control Centers. Two (2) contractor flights and eight (8) Air Force flights are planned from November 1981 to January 1983. The Air Force testing will be combined Development Test and Evaluation/Initial Operational Test and Evaluation.
- (U) The Development Test and Evaluation program has objectives to provide data in the areas of flight test, environmental test and operations, and maintenance demonstrations.
- (U) Flight test objectives are to provide W84 warhead flight test data to the Department of Energy, investigate launch environment effects on the Transporter Erector Launcher, and provide data to evaluate system performance for compliance with the system specification.
- (U) Environmental test objectives address the adequacy of the Ground Launched Cruise Missile system to function through its specified range of environment.
- (U) The operations and maintenance demonstrations will focus on maintenance of the Ground Launched Cruise Missile ground systems since the Ground Launched Cruise Missile maintenance concept provides for only limited maintenance on the missile.
- (U) The primary test site will be the Utah Test and Training Range with tests also conducted at Aberdeen Proving Ground, MD, Eglin Air Force Base, FL, and Kirtland Air Force Base, NM. Tests will be conducted using a total of three (3) Launched Control Centers, four (4) Transporter Erector Launchers, and nine (9) missiles. Recovery and refurbishment of flight tested missiles will enable multiple test launches of a single missile.

Budget Activity: Ground Launched Cruise Missile
Program Element: 64362F

(U) An Extended Storage Program during Developmental Test and Evaluation/Initial Operational Test and Evaluation will use a Transporter Erector Launcher, a Launch Control Center, and 4 missiles to help assess Ground Launched Cruise Missile system reliability. One missile will be launched at the end of the Extended Storage Program as the last of the eight Air Force launches.

2. (U) Operational Test and Evaluation:

(U) No formal operational test and evaluation has been accomplished on the Ground Launched Cruise Missile weapon system; however, the Joint Cruise Missiles Project Office conducted an initial phase of survivability testing between January and October 1978. Seven test flights were flown with the Tomahawk Sea Launched version against various simulated airborne and ground defensive threats to obtain generic detection and tracking data. Further test data will be obtained from Phase II survivability flights during Air Launched Cruise Missile initial operational test and evaluation, Sea Launched Cruise Missile technical evaluation/operational evaluation and Ground Launched Cruise Missile combined development test and evaluation/initial operational test and evaluation. Applicable results will be applied to the Ground Launched Cruise Missile design and the planning of survivability objectives for the initial operational test and evaluation.

(U) The combined Development Test and Evaluation/Initial Operational Test and Evaluation is scheduled for December 1981 through January 1983. Those aspects of Sea Launched Cruise Missile mission reliability and performance which reflect Ground Launched Cruise Missile operational requirements will be used in conjunction with formal Ground Launched Cruise Missile Operational Test and Evaluation flight test data.

(U) The purpose of Initial Operational Test and Evaluation will be to provide a valid estimate of the operational effectiveness and suitability of the Ground Launched Cruise Missile Weapon System for Defense System Acquisition Review Council III, scheduled for May 1983. The Air Force Test and Evaluation Center will manage Initial Operational Test and Evaluation. The Tactical Air Command, United States Air Forces Europe, Air Training Command, Air Force Logistics Command, Military Airlift Command, and Electronic Security Command will participate. Personnel from Commander in Chief Europe may participate in Initial Operational Test and Evaluation of the Mission Planning Subsystem.

(U) The principal test location will be the Utah Test and Training Range where ten flights (two contractor and eight Air Force) using pre-production prototype missiles will be launched. Subject to host government concurrence, it is planned to conduct six weeks of Initial Operational Test and Evaluation (except actual launch) at a European site representative of planned operational conditions. This will occur near the end of the combined Development Test and Evaluation/Initial Operational Test and Evaluation program.

Budget Activity: Ground Launched Cruise Missile
 Program Element: 64362F

(U) Excepting depot level and decentralized maintenance facility equipment, the Ground Launched Cruise Missile weapon system will be available for Initial Operational Test and Evaluation in at least preproduction prototype form. All test air vehicles will have telemetry packages and most will have a recovery package in place of one fuel tank. Service personnel will operate and maintain the weapon system during Initial Operational Test and Evaluation. Availability, reliability, maintainability, and logistic supportability are major operational suitability test objectives. A system approach to the evaluation of availability will be conducted. Both mission and logistics reliability will be evaluated. Quantitative (critical, high interest, and desirable maintenance and operational demonstrations which will be accomplished by Air Force personnel) and qualitative maintainability evaluations will be performed. A qualitative logistics supportability evaluation will be conducted with emphasis on Air Force Logistics Command capability to support the system. Mature system evaluation criteria (thresholds, standards, and goals) will be established for significant areas of evaluation. The system effectiveness data system will be used to collect reliability and maintainability test data. Service reports will be submitted in accordance with Section V, Technical Order OO-35D-54 (United States Air Force Material Deficiency Reporting and Investigating System). Data emanating from the Air Launched Cruise Missile program will be used as appropriate.

(U) Operational testing of the Ground Launched Cruise Missile weapon system will continue after Defense System Acquisition Review Council III. This Follow-on Operational Test and Evaluation effort will be accomplished in two phases. Phase I will be managed Air Force Test and Evaluation Center and will primarily consist of continued testing to complete test objectives not fully accomplished during Developmental and Operational testing. A reexamination of deficiencies and areas of concern surfaced during prior testing and a quantitative evaluation of logistics supportability will occur. Phase II will be conducted by Tactical Air Command to refine tactics and training and to provide for a continuing analysis of operational effectiveness and suitability to include system reliability, maintainability, availability, and changes in operational performance. Tactical Air Command has charged the Tactical Air Warfare Center to develop a Follow-on Operational Test and Evaluation concept and test plan. Preliminary planning of the management, schedule, and extent of Follow-on Test and Evaluation is being accomplished.

3. System Characteristics

<u>Characteristic</u>	<u>Objective</u>	<u>Threshold</u>	<u>Demonstrated</u>
<u>TOMAHAWK (BGM-109)</u>			
Length (without booster)	219 inches		Not Applicable
Weight	2700 pounds		Not Applicable
Warhead (W84)			Department of Energy Verification Developmental Test and Evaluation
Speed			

Budget Activity: Ground Launched Cruise Missile
 Program Element: 64362F

Range	2500 kilometers		Developmental Test and Evaluation Initial Operational Test and evaluation Developmental Test and Evaluation/ Initial Operational Test and Evaluation Not Applicable Not Applicable
Circular Error Probability			Not Applicable
Transporter Erector Launcher	10 ton M.A.N. Truck Tractor 4 Missiles per Transporter Erector Launcher Weight Approximately 78,000 pounds Air Transportable (C-130, C-141, C-5)		Not Applicable
Launch Control Center	Contains Communication and Launch Control Systems Controls 4 Transporter Erector Launchers		Initial Operational Test and Evaluation Not Applicable Not Applicable
System Reliability	10 ton Truck Tractor Weight Approximately 78,000 pounds .85	.80	Not Applicable Not Applicable Initial Operational Test and Evaluation
Operational Availability		To Be Determined	Initial Operational Test and Evaluation
Mean Time to Repair (non-missile)	30 minutes		
Planned Developmental Test and Evaluation/Initial Operational Test and Evaluation Flights			
Contractor Flights Completed	1		
Contractor Flights Remaining	2		
Air Force Test Flights (combined Developmental Test and Evaluation/Initial Operational Test and Evaluation			
	$\frac{8}{11}$		

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64601F

DOD Mission Area: Air Warfare Support, #225

Title: Chemical/Biological Defense Equipment
Budget Activity: Tactical Program, #4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT 4,025 7,000 9,000 10,100 Continuing Continuing							
3320	Biological Agent Detection			100	2,000		
3321	Chemical Agent Detection	1,600	3,400	4,400	4,800		
3337	Individual Protection	1,900	2,200	2,900	2,500		
3762	Collective Protection	200	600	600	400		
3764	Decontamination	225	600	900	400		
5171	BIGEYE	100	200	100			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: A marked imbalance in Chemical Warfare (CW) capabilities favoring the Warsaw Pact over the North Atlantic Treaty Organization (NATO) raises a significant threat of CW employment. The objective of this program is to develop chemical and biological warfare defense equipment to ensure survival and to continue operations in a toxic environment. The program encompasses six projects: Biological Agent Detection Chemical Agent Detection; Individual Protection; Collective Protection; Decontamination; and the BIGEYE retaliatory, binary chemical munition.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This fiscal year's funding will enable dual contract starts on an area chemical agent detector and single-layered aircrew protective clothing. The surface contamination monitor program will conclude with a production decision. Studies of overall base functions in a toxic environment will be completed. Evaluations will continue for collective protection techniques for fixed and mobile facilities and of proposals for advanced decontamination systems. Improved aircrew eye/respiratory systems will be readied for production. Improved fabrics for aircrew body protection will be tested. Development of the Automatic Liquid Agent Detector will be completed. Cost estimates are based on contractor information and prior negotiations.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	3,800	7,000	8,600		Continuing		Not Applicable
Procurement (3080)(PE 27593F)	8,000	11,000	18,600		Continuing		Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64601F

DOD Mission Area: Air Warfare Support, #225

Title: Chemical Biological/Defense Equipment
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element was initiated in 1971. Efforts at that time centered on monitoring Army development. With recognition of a significant threat increase in 1974-75, Air Force requirements were expanded. Near- and long-term programs were approved. Near-term objectives stressed acquisition of available equipment. The long-term program develops a full spectrum of equipment required to sustain operations in a chemical/biological warfare environment. Part of the long-term program is dedicated to correcting limitations of the near-term equipment; ultimate goals are to provide protection against the threat into the 1990s. The program element develops protective ensembles for aircrews, ground crews and special teams; personnel shelters; detection and warning devices; decontamination systems; and casualty-care equipment. The BIGEYE binary weapon is certified compatible with Air Force aircraft through test work conducted with the Navy, the executive developer.

(U) RELATED ACTIVITIES: DOD Directive 5160.5 establishes the Department of the Army as Executive Agent for all research, exploratory development, and advanced development. However, individual service efforts are encouraged to plan, program, budget, fund and perform exploratory and advanced development when necessary to meet service unique requirements. Air Force programs: Program Element (PE) 27593F, Chemical Warfare Defense Equipment, the procurement element for equipment developed in PE 64601F; PE 62202F, Aerospace Biotechnology, some research into biotechnological problems of chemical warfare; and PE 63745F, Chemical Warfare Defense. Army programs: PE 62706A, Chemical/Biological Defense and General Investigation; PE 63271A, Chemical/Defense Concepts; PE 64725A, Chemical Defense Material. Navy program: PE 62764N, Chemical/Biological Defense Technol Tasks are coordinated with the other Services.

(U) WORK PERFORMED BY: The Aeronautical Systems Division (AFSC), Wright-Patterson AFB, OH manages the defensive program. Principal contractors are: Honeywell, Inc., St. Petersburg, FL; Sierra Engineering, Sierra Madre, CA; Gentex Corporation, Carbondale, PA; Bendix Corporation, Towson MD; ILC Dover, Frederica DE; and Quest Incorporated, McLean, VA. The Armament Division (AFSC), Eglin AFB, FL manages Air Force certification of the BIGEYE weapon.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Components of the near-term aircrew and ground crew protective ensembles were selected, evaluated, produced and delivered to the field. Design criteria for collective-protection shelters at fixed installation were developed; additionally the KMU-450 shelter-modification kit was operationally tested and acquired. An automatic point-sampling chemical-agent detector completed evaluation, was produced, and entered the inventory. An evaluation of available decontaminants and dispensing equipment was accomplished. Air Force joined with the Navy in the BIGEYE binary chemical weapon development program. A prototype chemical casualty decontamination shower was developed. An integrated systems analysis of United States Air Force (USAF) chemical defense requirements was started. Studies to determine ingestion of chemical agents into aircraft cockpits through the environmental control systems were initiated. Four eye/respiratory systems continued competitive development in 1980 to provide long-term protection to aircrews without degrading their performance in a toxic environment. The surface contamination monitor effort advanced in 1980 with two contractors developing competitive designs. Broad collective protection and decontamination evaluations continued.

Program Element: #64601F

DOD Mission Area: Air Warfare Support, #225

Title: Chemical/ Biological Defense Equipment
Budget Activity: Tactical Programs, #4

2. (U) FY 1981 Program: The effort to develop a rapid, accurate electronic detection device for surface contaminants (surface contamination monitor) will reach a first-hardware-delivery stage. Contracts will be let for development of a base-wide area-detection system and single-layered aircrew protective fabrics. Evaluations of four candidate aircrew eye/respiratory systems will be completed, thus preparing a production decision. Contractual efforts for development of modular collective protection facilities and concepts for other fixed facilities' and mobile systems' protection will proceed. Additional work on defining contamination avoidance and decontamination systems will be undertaken. The Automatic Liquid Agent Detector final development contract is let.
3. (U) FY 1982 Planned Program: First item hardware deliveries on advanced decontamination equipment and collective protection systems will be evaluated. Production decisions are scheduled for the follow-on aircrew eye/respiratory system and surface-contamination monitor. Other Joint-Service developments under evaluation will be simplified collective protection systems, and improved hand and footwear. The Airbase Area Detection System will reach the preliminary design review stage; and the Automatic Liquid Agent Detection will complete development. Support for human performance-degradation tests to determine actual performance decrements of personnel wearing protective clothing will be provided.
4. (U) FY 1983 Planned Program: The Area Detection System continues development. Third generation aircrew protection systems will reach early engineering development. Improved collective protection and decontamination systems will be in advanced development stages. A biological-warfare agent detector selection/development program will be evaluated. Air Force operational tests of the new Joint-Service groundcrew protective mask will take place.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

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759-2608 (7608)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64602F

Title Armament/Ordnance Development
Budget Activity Tactical Programs, #4

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

PROJECT NUMBER	TITLE	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimate Cost
	TOTAL FOR PROGRAM ELEMENT						
2586	Dispenser Munitions	11,237	20,000	25,800	23,200	Continuing	N/A
2708	Aircraft Gun Systems	6,050	3,404	4,100	2,600	Continuing	N/A
3133	Bombs and Fuzes	1,485	13,600	12,000	1,000	0	28,085
4535	Fuel Air Explosives, Flame and Incendiary	800	1,400	3,700	7,700	Continuing	N/A
5613	Munitions Handling, Carriage and Release Equipment	250	60		0		0
		4,137	1,536	6,000	11,900	Continuing	N/A

1/ Funds transferred from the Navy.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is the primary source for modernizing unguided air-to-surface conventional weapons and associated equipments. Included are guns, bombs, fuzes, dispenser munitions, fuel air explosives, supersonic delivery hardware, and munitions handling equipment. These weapons provide operational forces with new capabilities to fill operational voids and eliminate deficiencies in current capabilities. For example, the GPU-5A 30 millimeter gun pod provides antiarmor tank killing capabilities to existing aircraft while modern munitions such as the Combined Effects Munition provides the operational forces with a multi-purpose munition which can be carried at supersonic speeds.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Fiscal Year 1982 program is a continuation of work started in prior fiscal years with the exception of the Joint Air Force/Navy fuze development program, FMU-139, and the 30 millimeter gun pod programs which were started in 1980. Specifically, this program element supports four projects which are further divided into eight tasks. Two of these tasks, the multiple stores ejector rack and the FMU-139 common bomb fuze are Joint Air Force/Navy programs. Cost estimates are provided by the respective program office and are derived by those offices.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimate Costs
Procurement (Other) (PE 28030)	12,100	12,300	13,800		Continuing	N/A
	13,500	15,900	50,700		Continuing	N/A

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) (PE 27128) 54,400 190,400

Procurement (Other) (PE 28030) 61,832 Continuing N/A

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Program Element: #64602F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title Armament/Ordnance Development
Budget Activity Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is the primary development source for aerial delivered conventional weapons. The objective of the program is to provide the tactical and strategic operational forces with an effective conventional weapon operational capability. Activities involve the engineering design, development, test and evaluation of a variety of improved conventional weapons and weapons handling equipment. The program includes the following types of weapons/equipment: bomb fuzes; bomblets optimized for use against personnel, materiel, armored and other vehicles; dispensers for these bomblets; munitions handling equipment; standardized, aircraft release equipments; antitank gun pods; and devices to permit supersonic carriage and delivery. The efforts underway or planned in this program can be divided into two categories: those aimed at providing the operational forces with new capabilities to fill operational voids, and those aimed at eliminating deficiencies in current capabilities. For example, this program develops dispenser munitions which will permit full utilization of aircraft capabilities in terms of low altitude supersonic delivery. Also, there are programs such as bomb fuzing, standardized bomb racks, and munitions handling equipment which will use current technology to provide improved capabilities in terms of safety, reliability, operational flexibility and ease of maintenance. Efforts in this program are completed with formal standardization of the munitions/equipment and with independent assessments by the development and operations communities to the effect that the item has successfully completed development, demonstrated operational utility and suitability, and is ready for production.

(U) RELATED ACTIVITIES: Items from the advanced development program, Program Element 63601F Conventional Weapons, are selected for continuation into a Full Scale Engineering Development under this Program Element. Close liaison is maintained between the Services through the Joint Technical Coordinating Group for Munitions Development and through formal coordination with the Department of Defense Armaments/Munition Requirements and Development Committee. There are four efforts in this program element which are multi-Service. The Multiple Stores Ejector Rack and the Common Bomb Fuze are joint Air Force/Navy developments. The Air Force is lead development Service for the Multiple Stores Ejector Rack and the Navy is lead on the Common Bomb Fuze. The 30 millimeter antitank gun pod began as an Independent Research and Development project by General Electric.

(U) WORK PERFORMED BY: This program is managed by the Armament Division at Eglin AFB, FL. Most of the hardware effort is contracted with industry, the major Fiscal Year 1981 contractors being Aerojet, Downey, CA (Combined Effects Bomblet); Dayron Corporation, Orlando, FL (FMU-130 Fuze); Western Gear Corporation, Jamestown, ND (Multiple Stores Ejector Rack); and General Electric, Burlington, Vermont (The 30MM Gun Pod). The Naval Air Systems Command, Washington, DC, is managing the FMU-139 program (Motorola Incorporated, Scottsdale, AZ).

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Program Element: #64602F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title Armament/Ordnance Development
Budget Activity Tactical Program, #4

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

Project 2586: The Tactical Munitions Dispenser met a Critical Design Review and Tactical Munitions Dispensers for the Development Test and Evaluation/Initial Operational Test and Evaluation of the CBU-89/B, GATOR mine system, and CBU-87/B, Combined Effects Munition were fabricated. Engineering verification and Military Standards testing was conducted on the fuze and the orientation/stabilization device for the Combined Effects Bomblet. The Combined Effects Bomblet packaged in the Tactical Munitions Dispenser is the CBU-87/B Combined Effects Munition.

Project 2708: With Navy funding, 30 Millimeter Gun Pod contract awarded.

Project 3133: The FMU-112/B fuze completed Initial Operational test and Evaluation, and contracting for the initial production units started. The FMU-130/B Phase III Full Scale Development contract was negotiated with Dayron Corporation, Orlando FL, on a fixed price, incentive fee basis. The FMU-139/B was initiated with request for proposal release and source selection activity begun.

Project 4535: Prototype models of the Navy/Air Force Fuel Air Explosive weapons were produced and ground tests completed.

Project 5613: The Air Inflatable Retarder program completed Initial Operational Test and Evaluation and production started. Multiple Stores Ejector Racks delivered for a limited F-16 and A-7 flight test evaluation. Current design causes unacceptable drag, and therefore, only rack qualification and limited tests on existing design completed. Wind tunnel tests of low drag modification were conducted. Evaluation of munition containers will continue.

2. (U) FY 1981 Program:

Project 2586: The Tactical Munitions Dispenser will be used in the combined Development Test and Evaluation/Initial Operational Test and Evaluation of the GATOR mine system. The Combined Effects Munition will complete engineering verification and Military Standards testing.

Project 2708: Contractor design deficiencies will be corrected. Development Test and Evaluation/Initial Operational Test and Evaluation of the 30 Millimeter Gun Pod will start early FY81 and a production contract will be awarded for the initial pod deliveries.

Project 3133: FMU-130 contract will begin First Quarter FY 1981. Fuze design will be finalized and Critical Design Review will be conducted in August 1981. FMU-112/B will begin limited production. FMU-139 will begin Full Scale Development with engineering model hardware undergoing laboratory testing.

Project 4535: Air Force participation in the Fuel Air Explosive program is terminated.

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Program Element: #64602F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title Armament/Ordnance Development
Budget Activity Tactical Program, #4

Project 5613: The Multiple stores Ejector Rack program is being restructured to allow redesign to reduce aerodynamic drag to limits acceptable to Tactical Air Command and the Navy. Evaluation of munitions containers will continue. Establish Material Munitions Handling Equipment (MMHE) focal point to analyze weapons handling effectiveness and determine deficiencies and needs.

3. (U) FY 1982 Planned Program:

Project 2586: Development of the Tactical Munitions Dispenser and the Combined Effects Bomblet will continue and will start the final test phase through the Initial Operational Test and Evaluation of the Combined Effects Munition.

Project 2708: Complete the initial flight tests and start Development Test and Evaluation/Initial Operational Test and Evaluation of the 30 millimeter gun pod; Critical Design Review will be conducted. \$12.0 million increase in the FY 1982 estimate is due to the addition of this program.

Project 3133: FMU-130 contractor will be designing special tools and testing fixtures and designing the Research and Development assembly line which will be used to demonstrate the fuze can be assembled by automatic methods. FMU-139 design will be conducted, prototype hardware built, and Development Test and Evaluation testing will begin. \$0.3 million increase in the FY 1982 estimate is due to the addition of this program.

Project 5613: Development of a low drag Multiple Stores Ejector Rack will continue, a design review completed and modification of hardware started. Initiate development of equipment for sustained combat rapid assembly of munitions capability.

4. (U) FY 1983 Planned Program:

Project 2586: Combined Effects Munition, Initial Operational Test and Evaluation will be completed and production recommendations will be made.

Project 2708: 30 millimeter gun pod development will be completed and production will continue.

Project 3133: Complete development and start initial operational test and evaluation of the FMU-130 mechanical fuze and complete initial operational test and evaluation of the FMU-139 joint Navy/Air Force common bomb fuze.

Project 5613: Development Test and Evaluation on the Low Drag Multiple Stores Ejector Rack will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

Project: #2708

Program Element: #64602

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Aircraft Systems

Title: Armament/Ordnance Development

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The 30 Millimeter Gun Pod is a reliable, easy to employ, antiarmor weapon for the A-7, F-4, and F-16 aircraft. A concurrent Full Scale Engineering development and production program was initiated in Fiscal Year 1980 to provide the Rapid Deployment Forces and other tactical forces a near term (Initial Operational Capability 1983) relatively low cost capability with tank killing firepower. The 30 Millimeter Gun Pod (GPU-5/A) is a four-barrel Gatling gun and fires the same ammunition as the seven-barrel GAU-8 Gatling gun used in the A-10 aircraft.

(U) RELATED ACTIVITIES: PE 27128-F4 Squadrons.

(U) WORK PERFORMED BY: General Electric, Burlington, Vermont, Armament Division, Elgin AFB, Florida.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Full Scale Engineering Development was initiated and the initial order of long lead production parts (\$5 million) was made.

2. (U) FY 1981 Program: Correct low to moderate risk design deficiencies, conduct initial development tests, and award a production contract for the initial pods.

3. (U) FY 1982 Planned Program: Complete development and operational tests and evaluation; deliver the initial 40 production pods.

4. (U) FY 1983 Planned Program: Complete development program (clean up) and begin delivery of the second production increment of 120 production pods.

5. (U) Program to Completion: Complete delivery of 520 gun pods.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD7&E	1,485	13,600	12,000	1,000	0	28,085
Procurement (Aircraft) (PE 27128F)	5,000	33,000	43,000	54,400	55,000	190,400

8. (U) Comparison with FY 1981 Budget Data:

RD7&E Program initiated during Fiscal Year 1980

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765-766B

765-766B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64604F
DoD Mission Area: Counter Air, #221

Title: Low Altitude Airfield Attack System
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	31,699	66,000	60,000	38,900	12,300	272,690
2430	JP-233	31,699	66,000	60,000	38,900	12,300	272,690

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for United States participation in the joint United States/United Kingdom development of specialized munitions capable of being delivered from low altitude high speed attack aircraft against Warsaw Pact airfields. The system being developed under this program, known as JP-233, includes submunitions with dispensers unique to each. This program will provide a common weapon system for use by the two developing countries in meeting a common operational requirement. The United States Air Force requirement is identified in the Tactical Air Forces Statement of Need (306-79) for Airfield Attack Munitions. Other North Atlantic Treaty Organization countries will be urged to procure the system.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for the United States share of the continuing year of Full Scale Development of the joint United States/United Kingdom JP-233 program. Development goals for this period focus on initiating flight tests of the engineered standard hardware and completing flight tests of the development standard submunitions. Cost estimates are planning estimates based on best-known information as of December 1980. Actual costs are to be negotiated with the United Kingdom.

(U) COMPARISON WITH FY81 DESCRIPTIVE SUMMARY:

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	RDT&E	25,300	56,000	31,800		54,500	218,900
	PROC (OTHER)(PE28030F)			TDB		TDB	TDB

(U) OTHER APPROPRIATION FUNDS:

Procurement (OTHER)(PE28030F)
Quantity (JP-233 Systems)

1/ TBD

1/ Funding for a generic airfield attack munition, beginning in FY 1983, is provided for under Program Element 28030.

Program Element: #64604P

DoD Mission Area: Counter Air, #221

Title: Low Altitude Airfield Attack System
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The offensive capability of Warsaw Pact tactical air forces poses a formidable threat to North Atlantic Treaty Organization forces. Although the Pact air threat can be countered with air-to-air and surface-to-air systems either currently available or under development, a most effective counter is to deny the enemy his sortie generation capability.

(U) RELATED ACTIVITIES: This is a joint program with the United Kingdom which has as an objective the standardization and interoperability of an air-to-surface munition. The program is being executed under a Memorandum of Understanding between the United States Department of Defense and the United Kingdom Ministry of Defence. The program is being managed from the United Kingdom Ministry of Defence in London with United States Air Force personnel incorporated into a joint program office. A United States Air Force System Program Director is the associate manager of the program.

(U) WORK PERFORMED BY: The work will be primarily performed in the United Kingdom with Hunting Engineering Limited as prime contractor. The United States Air Force agency with prime cognizance and through which direction and funds will be channeled is the Armament Division at Eglin Air Force Base, Florida.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Based on feasibility studies conducted in the early 1970s, the United Kingdom Government in 1975 approved the program for the Project Definition Phase where considerable preliminary design work and initial advanced development of the submunitions and dispensers were accomplished. The United States Air Force became a participant in the program in August 1976 for the purpose of evaluating the system and determining the feasibility of becoming a full partner in the development program. A joint Project Definition Phase was followed by a Validation Phase which led to a joint United States/United Kingdom full scale development decision in October 1977. Early Full Scale Development activities focused on designing of dispensers suitable for use on both the United States F-111 and the United Kingdom Tornado aircraft and testing submunition designs. A dispenser design for use with the submunition was selected after successful wind tunnel testing which confirmed the compatibility of this design with the F-111. The submunition dispenser design was also selected and has completed similar testing. Arena and other ground tests were conducted on the submunitions warheads culminating in successful ground dynamic tests of full-up submunitions in 1980. Unilateral United States development of an submunition commenced in FY 1978 following studies which showed that such a submunition could provide a significant improvement in overall capability of the entire JP-233 system.

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Program Element: #64604F

DoD Mission Area: Counter Air, #221

Title: Low Altitude Airfield Attack System
Budget Activity: Tactical Programs, #4

The baseline Development Cost Plan was finalized in January 1979 with the United Kingdom contractor and Ministry of Defence, and a cost growth due to technical factors was identified in May 1980. Final approval of the revised program is expected in 1981. The estimated cost growth is between 10 and 12 percent in base year 1978 pounds sterling. Because of the technical problems intermediate milestones have slipped; however, the program completion date remains

Ground trials with Development Standard dispensers commenced in 1980 to prove adequacy of design, interface with test aircraft, and pave the way for live full-up weapon system trials. Development and evaluation of the submunition continued. The FY 1980 difference of \$6.49 Million adjusts for higher-than-projected United Kingdom inflation, higher-than-projected dollar-to-pound sterling exchange rate, and a revision in the apportionment plan for distribution of funds by fiscal years.

2. FY 1981 Planned Program: Flight testing of full-up live submunitions will commence in the summer of 1981, with weapons delivery from the Buccaneer aircraft. Tests will start with single submunitions being dispensed and will build towards demonstrating the capability to dispense full dispenser loads. Flight tests of the development standard dispensers will be completed, and ground tests of the engineered standard dispensers will be initiated. The FY 1981 cost increase of \$10.0 Million is due to unfavorable United Kingdom inflation and currency exchange rates and to charges to terminate and restart United States-unique activities.

3. (U) FY 1982 Planned Program: Flight trials of the Development Standard system will be completed using the Buccaneer aircraft. Ground tests of the engineered standard system will be completed and, flight trials of the engineered standard system will commence with initial tests from the Buccaneer aircraft. The FY 1982 cost increase of \$28.2 Million is due to unfavorable United Kingdom inflation and currency exchange rates and real cost growth.

4. (U) FY 1983 Planned Program: Flight trials of the engineered standard system will be completed and combined munition tests of the engineered standard system will be initiated. A review of the requirement and technical performance will be conducted to support a decision to enter a joint preproduction phase with the United Kingdom. The \$3.3 Million reduction in FY 1983 and cost-to-complete estimates is due to revision of the apportionment plan for distribution of funds by fiscal years.

5. (U) Program to Completion: During the remainder of the program the all-up system will experience Initial Operational Test and Evaluation using the F-111 and Tornado aircraft. Producibility efforts will continue and, depending on the decision to enter a joint preproduction phase, procurement of long lead items and tooling for production will be undertaken.

6. (U) Milestones: To be negotiated

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64607F

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
<u>TOTAL FOR PROGRAM ELEMENT</u>							
2579	Antiarmor Cluster Munition (ACM)	1,999	18,800	21,200	4,100	0	46,099
2581	Extended Range Antiarmor Munition (ERAM)			1,000	23,900	44,000	68,900
2582	Wasp Minimisile				12,400	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Tactical Air Forces require a capability to destroy multiple enemy tanks during a single aircraft pass in order to overcome the existing large numerical imbalance of armor while reducing aircraft exposure to enemy defensive fire. This critical need is well documented in the Mission Element Need Statement for an Improved Wide Area Antiarmor Capability. The Wide Area Antiarmor Munition (WAAM) program has been initiated to address this need. It will accomplish full scale development, culminating in production decisions, of the three WAAM weapons: the Antiarmor Cluster Munition, the Extended Range Antiarmor Munition, and the Wasp minimisile.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Fabrication of 170 Antiarmor Cluster Munition test items and system qualification will be completed. The major portion of Initial Operational Test and Evaluation will be conducted to measure the probable number of armor kills-per-pass and to estimate operational reliability. Development of the Extended Range Antiarmor Munition - an air-delivered land mine - will be initiated in late 1982 following completion of concept validation and a Milestone II review of the program. Cost estimates are based on contractual commitments, and test activity and parametric estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RD&E	20,600	20,300	17,700		Continuing	Not applicable
Procurement (OTHER) (PE 28030F)			58,875		391,525	450,400

Program Element: # 64607F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated</u>
						<u>Costs</u>
<u>OTHER APPROPRIATION FUNDS:</u>						
Procurement						
Antiarmor Cluster Munition (OTHER) (PE 28030F)			54,400		799,130	853,530
Extended Range Antiarmor Munition (OTHER) (PE 28030F)					TBD	TBD
Wasp (MISSILES)					TBD	TBD
(Quantity)				(636)		
Antiarmor Cluster Munition					TBD	TBD
Extended Range Antiarmor Munition					TBD	TBD
Wasp						

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Program Element: # 64607F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title Wide Area Antiarmor Munitions
Budget Activity Tactical Programs #4

DETAILED BACKGROUND AND DESCRIPTION: The Mission Element Need Statement for an Improved Wide Area Antiarmor Capability details the critical need for the Tactical Air Forces to improve their armor kill capability against massed rear echelon armor. The Wide Area Antiarmor Munitions (WAAM) Program will improve the Tactical Air Forces sortie effectiveness by increasing the number of armor kills per pass.

The need is to develop a weapon that will provide multiple kills per pass, during all hours and weather conditions and from extremely low altitudes or standoff distances. The ability to achieve multiple kills during a single pass will greatly improve the Tactical Air Forces' antiarmor capability while decreasing attrition to enemy defenses. WAAM has been designated a major program and will use multiple contractors to reduce cost/schedule risk in order to achieve an operational capability at the earliest possible time. Three weapons -- the Antiarmor Cluster Munition, the Wasp Minimissile, and the Extended Range Antiarmor Munition -- will be validated developed in this program. The Antiarmor Cluster Munition is an unguided improved antiarmor area cluster bomb that may be delivered at minimum altitudes or higher. The Antiarmor Cluster Munition submunition could also be packaged in a standoff delivered dispenser. The Wasp is a minimissile that employs a terminal seeker and a lock-on-after-launch guidance mode. The Wasp is intended for delivery from aircraft-mounted pods for minimum altitude attack. The Extended Range Antiarmor Munition is an air-delivered cluster weapon containing target-activated land mines that provide a standoff kill capability against armor. The target does not have to contact the Extended Range Antiarmor Munition submunition to effect a kill; rather the mine's sensor classifies the target, determines the closest point of approach, and then fires a warhead at the target.

(U) RELATED ACTIVITIES: WAAM technology support is ongoing in Program Element 62602F, Conventional Munitions, and Program Element 63601F, Conventional Weapons Technology. Warhead, sensor, seeker, and dispenser technology programs in these Program Elements provide the basis for the WAAM concepts. Weapon concept demonstration/validation is accomplished in Program Element 63609F Advanced Attack Weapons. Other related Air Force programs (PAVE MOVER, F-16, A-10, and Assault Breaker) will be integrated with WAAM to provide a total wide area antiarmor system capability.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin Air Force Base, FL. Contractor support for the Antiarmor Cluster Munition is provided by Honeywell Incorporated, Minneapolis MN. Contractor support for the Extended Range Antiarmor Munition will be provided by one of the two contractors currently competing in the validation program: AVCO Corporation, Wilmington MA and Honeywell. Likewise, one of the two contractors currently competing in the Wasp minimissile validation program - Boeing Aerospace Company, Seattle WA and Hughes Aircraft Company, Canoga Park CA - will be selected as the contractor for Wasp full scale development.

(U) PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. (U) FY 1980 & PRIOR ACCOMPLISHMENTS: The final phase of validation for the Antiarmor Cluster Munition (ACM) was successfully completed in FY 1980 with system development and validation tests. ACM advanced in mid FY 1980 into this

Program Element: # 64607F

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

program element to begin subsystem design, fabrication, and testing. Honeywell was selected as the full scale development contractor. In early 1980, \$20.4 million previously programmed funds were given up to offset Indian Ocean activities. Subsequently, \$1.99 million was reprogrammed back into this program element.

2. (U) FY 1981 PLANNED PROGRAM: The Antiarmor Cluster Munition will continue full scale development. System design of test items for Development Testing and Evaluation and testing of critical subsystems will be completed in FY 1981. The FY 1981 program was reduced by \$1.5 million in the authorization process.

3. (U) FY 1982 PLANNED PROGRAM: The effort to be conducted in this program in FY 1982 will include completion of system design, fabrication, test and qualification of the ACM. A significant portion of Initial Operational Test and Evaluation will be conducted during FY 1982 to measure the probable number of armored kills-per-pass, and to estimate operational reliability. Operational suitability will be determined, including availability, maintainability, and logistics supportability of the ACM. One hundred and seventy ACM's will be tested. Producibility studies will be continued this year. Low Rate Initial Production could begin in early FY 1982 if funds are made available. The Extended Range Antiarmor Munition (ERAM) will complete validation in program element 63609F in the third quarter of FY 1982, and will transition into this program element in late FY 1982. Funding is increased in FY 1982 to recover FY 1980-81 losses.

4. (U) FY 1983 PLANNED PROGRAM: ACM will complete Full-Scale Development (FSD) in the first quarter of FY 1983. Production will begin in early FY 1983, following a full rate production decision in the first quarter of FY 1983. The Wasp minimissile will complete validation in Program Element 63609F in FY 1983 and will transition into this program element for full scale development following a Milestone II review.

5. PROGRAM TO COMPLETION: The Extended Range Antiarmor Munition will complete development in FY 1985, and the Wasp minimissile in FY 1986. Total estimated costs of procurement are increased due to an increase in the inventory objective from
Antiarmor Cluster Munition units.

6. (U) MILESTONES:

	Date
A. Antiarmor Cluster Munition (ACM) Milestone II (Full Scale Development) Review	(May 1980)* Jul 1980
B. ACM Low Rate Initial Production (LRIP)	(Oct 1981)* Jan 1983
C. ACM Milestone III (Production Decision) Review	(May 1983)* Jan 1983
D. Extended Range Antiarmor Munition (ERAM) Milestone II Review	(FY 1984)* Apr 1982
E. Wasp Minimisile Milestone II Review	(FY 1983)* FY 1983
F. ERAM Milestone III	FY 1985
G. Wasp Milestone III	FY 1986

* Date presented in FY 1981 Descriptive Summary

Program Element: # 64607F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Wide Area Antiarmor Munitions
Budget Activity: Tactical Programs, #4

EXPLANATION OF MILESTONE CHANGES:

A, B, and C above: Beginning of ACM full scale development delayed due to FY 1980 funding cut.

B and C above: Initiation of ACM production deferred until FY 1983 to preclude concurrency of development and production.

E and C above: Wasp program accelerated as a result of Congressional increase of funds in FY 1981 in Program Element (PE) 63609F.

7. (U) RESOURCES:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Costs</u>
RDT&E	1,999	18,800	22,200	40,400	Continuing 799,130	Not Applicable 853,530
Procurement (APPN 3080, PE 28030F)						

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

<u>Project Number</u>	<u>Title</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Continuing</u>	<u>Not Applicable</u>
RDT&E		20,600	20,300	17,700	391,525	450,400
Procurement (APPN 3080, PE 28030F)				58,875		

\$20,400 thousand FY 1980 funds given up to offset Indian Ocean Activities; \$1,999 thousand subsequently reprogrammed. FY 1981 request reduced \$1,500 thousand in authorization process. FY 1982 and FY 1983 increases recover FY 1980-81 losses. Inventory objective increased from Antiaarmor Cluster Munitions, resulting in higher estimated total procurement costs.

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Budget Activity: Tactical Programs, #4

Program Element: 63609F/64607F - Wide Area Antiarmor Munitions, Wasp and Extended Range Antiarmor Munition

1. (U) Development Test and Evaluation:

(U) Validation Phase: Development testing for the Extended Range Antiarmor Munition and the Wasp mini-missile will be conducted by their respective contractors in FY82-83. Honeywell Inc., and Avco Inc., are the competing Extended Range Antiarmor Munition contractors; Hughes Aircraft Corp., and Boeing Aerospace Co., are competing Wasp contractors. Common Development Test and Evaluation objectives for the validation phase are: (1) Demonstrate achievement of satisfaction pattern and kill mechanism performance, (2) Demonstrate the use of Wide Area Antiarmor Munition weapons in a variety of battlefield and countermeasure environments, (3) Demonstrate launch concepts and (4) Demonstrate the ability of Wasp and Extended Range Antiarmor Munition seekers to discriminate between real and false targets. Contractors will conduct extensive tests of critical subsystems: seekers, orientation and stabilization devices, and warheads. Dispenser drops of inert Extended Range Antiarmor Munition and launch of instrumented Wasps will be accomplished to establish footprints and accuracy. Live-round tests of individual submunitions will be conducted. Contractor development engineers and technicians will conduct development testing at Eglin Air Force Base and other appropriate test ranges. The Air Force Test and Evaluation Center will actively participate in this testing. Air Force Armament Division, Eglin Air Force Base, Florida, will manage the Development Test and Evaluation program.

(U) Full Scale Engineering Development: Development Test and Evaluation will be combined with Initial Operation Test and Evaluation. The majority of Development Test and Evaluation testing in Full Scale Development will be conducted by Air Force System Command's System Program Office and 3246th Test Wing personnel. Some remaining tests of subsystems will be accomplished by the contractors at their facilities. Development Test and Evaluation will be accomplished during (1) Extended Range Antiarmor Munition FY 84-85 and (2) Wasp - FY 85-86. Common test objectives for this phase are to establish baseline performance characteristics for each concept and kill mechanism, to verify the predicted number of kills per pass against specified targets and to determine the effect of probable countermeasures on system performance. An assessment of the system support concept in meeting logistic requirements will be made. Air Force Test and Evaluation Center will have overall management responsibility for the Initial Operational Test and Evaluation program. The combined Development Test and Evaluation/Initial Operation Test and Evaluation test program will include 116 Extended Range Antiarmor Munition units and 46 Wasp pods. Specific test locations are yet to be determined.

2. (U) Operational Test and Evaluation:

(U) No Wasp or Extended Range Antiarmor Munition operational test and evaluation has been accomplished to date.

(U) Demonstration and Validation Phase. Critical component and submunition tests will be conducted during this phase. The Air Force Test and Evaluation Center will actively participate in the Demonstration and Validation testing to determine, as much as possible, the projected operational effectiveness and suitability of each concept tested; however, no separate operational test and evaluation will be conducted. The objective of the Demonstration

and Validation phase operational test and evaluation is to determine the expected kills per pass of each concept when used in a realistic environment. This will be accomplished primarily by evaluating computer simulation and component test data. Most tests will be conducted by contractor personnel at contractor facilities. The remaining tests will be conducted by Air Force Systems Command personnel at Eglin Air Force Base, Florida.

(U) Full Scale Development. Operational test and evaluation will be conducted by Air Force Test and Evaluation Center during Full Scale Development with Development Test and Evaluation and Initial Operational Test and Evaluation events combined where feasible. Separate Initial Operational Test and Evaluation will be conducted for operational test and evaluation objectives which cannot be combined with Development Test and Evaluation. Combined and separate Initial Operational Test and Evaluation for each concept will be conducted during: (1) Extended Range Antiarmor Munition - FY 84 and FY 85, and (2) Wasp - FY 85 and FY 86. Common Initial Operational Test and Evaluation objectives for operational effectiveness during this phase are: (1) measure the expected number of kills per pass against armored company arrays, (2) estimate Wide Area Antiarmor Munitions performance in various battlefield and countermeasures environments, (3) estimate the ability of Extended Range Antiarmor Munition and Wasp to accurately discriminate between real and false targets, (4) estimate operational reliability, and (5) estimate the effect of target location error. An objective unique to Extended Range Antiarmor Munition is to measure its ability to disrupt or delay the movement of armor. An objective unique to Wasp is to measure its ability to lock-on after launch. The operational suitability objectives include determining the availability, maintainability, reliability, and logistics supportability of the systems. No unique suitability problems are anticipated. Test assets used during Full Scale Development, Development Test and Evaluation/Initial Operational Test and Evaluation will be soft tooled items which are representative of production items. Test assets programmed for separate Initial Operational Test and Evaluation are: Extended Range Antiarmor Munition - 54, and Wasp - 12. At this time specific subsystems and support equipment requirements have not been identified. Test program requirements for each concept will be defined as more data become available.

3. Systems Characteristics:

(C) Characteristics for each of the concepts will be definitized during validation. The objective of the program is to develop a system that can achieve multiple kills per pass of massed armor targets. The development goal is

775

225

Project: 2579

Program Element: #64607F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Antiarmor Cluster Munition

Title: Wide Area Antiarmor Munitions

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Antiarmor Cluster Munition (ACM) will meet the Tactical Air Forces' need for a multiple armor kill-per-pass capability against rear echelon wide area armored forces and for delivery from aircraft at minimum altitudes. This capability is required to blunt the Soviet massed armor threat by interdicting Soviet rear echelon armored forces before they can reinforce first echelon forces and achieve a breakthrough. The major goal of the ACM effort in this program element is to demonstrate the system capability to achieve multiple kills per pass under realistic test conditions. These tests will then form the basis for a production decision.

(U) RELATED ACTIVITIES: Wide Area Antiarmor Munitions (WAAM) technology base advancement is ongoing in Program Element (PE) 62602F, Conventional Munitions, and PE 63601F, Conventional Weapons Technology. Validation of concepts is ongoing in PE 63609F, Advanced Attack Weapons. Warhead, sensor, seeker, and dispenser technology projects in these PEs provide the basis for the WAAM concepts. Other related Air Force programs (e.g., F-16 and A-10) will be integrated with WAAM to provide a total wide area antiarmor system capability.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD and its subordinate organization, Armament Division, Eglin AFB, FL. Prime Contractor support is provided by Honeywell, Inc., Minneapolis, MN.

(U) PROGRAM ACCOMPLISHMENTS & FUTURE PROGRAMS:

1. (U) FY 1980 & PRIOR ACCOMPLISHMENTS: The final phase of concept validation for the Antiarmor Cluster Munition was successfully completed in FY 1980 with system development and validation tests. An Air Force Systems Acquisition Review Council conducted a Milestone II review of the program in July 1980 and recommended initiation of full scale development based on the success of the validation tests. A contract for full scale development was awarded to Honeywell, Inc., in July 1980. In early 1980, \$20.6 million previously programmed funds were given up to offset Indian Ocean Activities. Subsequently, \$1.99 million was reprogrammed back into this program element.
2. (U) FY 1981 PLANNED PROGRAM: ACM continues Full Scale Development. System design of test items for Development Test and Evaluation and critical subsystem testing will be completed in FY 1981. The FY 1981 program was reduced by \$1.5 million in the authorization process.
3. (U) FY 1982 PLANNED PROGRAM: Fabrication of 170 ACM test items will be completed. The major portion of Initial Operational Test and Evaluation will be conducted to measure the probable number of armor kills-per-pass and to estimate operational reliability. Low rate initial production is not planned for FY 1982, but production could be started concurrent with operational testing in 1982 should the need arise. Funding is increased in FY 1982 and FY 1983 to recover FY 1980-81 losses.
4. (U) FY 1983 PLANNED PROGRAM: ACM will complete Initial Operational Test and Evaluation in the first quarter of FY 1983. If a favorable recommendation is rendered at the Milestone III review, production will be initiated in January 1983.

Project: 2579

Program Element: #64607F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Antiarmor Cluster Munition

Title: Wide Area Antiarmor Munitions

Budget Activity: Tactical Programs, #4

5. PROGRAM TO COMPLETION: Production will continue until the ACM inventory objective is met. Total estimated costs of procurement have increased due to an increase in the inventory objective from

6. (U) MILESTONES:

	<u>DATE</u>
A. Antiarmor Cluster Munition (ACM) Milestone II (Full Scale Development) Review	(May 1980)* Jul 1980
B. ACM Low Rate Initial Production	(Oct 1981)* Jan 1983
C. ACM Milestone III (Production Decision) Review	(May 1983)* Jan 1983

* Dates presented in FY 1981 Descriptive Summary

EXPLANATION OF MILESTONE CHANGES:

A above: Beginning of full scale development delayed due to FY 1980 funding cut.

B and C above: Initiation of ACM production deferred until FY 1983 to preclude concurrency of development and production.

7. (U) RESOURCES: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E	1,999	18,800	21,200	4,100	799,130	46,099
Procurement (OTHER) (PE 28030F)				54,400		853,530

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

RDT&E	20,600	20,300	4,100			45,000
Procurement (OTHER) (PE 28030F)			58,875		391,525	450,400

(U) \$20,400 thousand FY 1980 funds given up to offset Indian Ocean Activities; \$1,999 thousand subsequently reprogrammed. FY 1981 request reduced \$1,500 thousand in authorization process. FY 1982 and FY 1983 increases of \$17,100 thousand and \$4,100 thousand respectively recover FY 1980-81 losses.

Inventory Objective is increased from
total estimated costs.

Antiarmor Cluster Munition units, resulting in higher

Budget Activity: Tactical Programs, #4

Element: 64607F - Antiarmor Cluster Munition

1. (U) Development Test and Evaluation:

(U) Validation Phase: Development testing was conducted by Martin Maritta and Honeywell Inc, the competing validation phase contractors, in 1979-1980. These tests were supported and evaluated by Air Force Systems Command personnel. Development Test and Evaluation objectives for the validation phase were to demonstrate achievement of satisfactory pattern and kill mechanism performance. Contractors conducted extensive tests of critical subsystems: safe-and-arm systems, orientation and stabilization devices, and warheads. Dispenser drops of inert Antiarmor Cluster Munitions were accomplished to establish footprints and accuracy. Live-round tests of individual submunitions were conducted. Contractor development engineers and technicians conducted development testing at contractor facilities, Eglin Air Force Base and other appropriate test ranges. Air Force Armament Division, Eglin Air Force Base, Florida, managed the Development Test and Evaluation program.

(U) Full Scale Engineering Development: Development Test and Evaluation will be combined with Initial Operation Test and Evaluation. The majority of Development Test and Evaluation testing in Full Scale Development will be conducted by Air Force System Command's System Program Office and 3246th Test Wing personnel. Some remaining tests of subsystems will be accomplished by the contractors at their facilities. Development Test and Evaluation will be accomplished during FY 81-82. Test objectives for this phase are to establish baseline performance characteristics, to verify the predicted number of kills per pass against specified targets and to determine the effect of probable countermeasures on system performance. An assessment of the system support concept in meeting logistic requirements will be made. Air Force Test and Evaluation Center will have overall management responsibility for the Initial Operational Test and Evaluation program. The combined Development Test and Evaluation/Initial Operation Test and Evaluation test program will include 170 Antiarmor Cluster Munition units. Specific test locations are yet to be determined.

2. (U) Operational Test and Evaluation:

(U) Demonstration and Validation Phase. Critical component and submunition tests were conducted during this phase. The Air Force Test and Evaluation Center participated in the Demonstration and Validation testing to determine, as much as possible, the projected operational effectiveness and suitability of the concept; however, no separate operational test and evaluation was conducted. The objective of the Demonstration and Validation phase operational test and evaluation was to determine the expected kills per pass of the concept when used in a realistic environment. This was accomplished primarily by evaluating computer simulation and component test data. Most tests were conducted by contractor personnel at contractor facilities. The remaining tests were conducted by Air Force Systems Command personnel at Eglin Air Force Base, Florida.

(U) Full Scale Development. Operational test and evaluation will be conducted by Air Force Test and Evaluation Center during Full Scale Development with Development Test and Evaluation and Initial Operational Test and Evaluation events combined where feasible. Separate Initial Operational Test and Evaluation will be conducted for operational test

and evaluation objectives which cannot be combined with Development Test and Evaluation. Combined and separate Initial Operational Test and Evaluation for the Antiarmor Cluster Munition will be conducted during FY 82 and FY 83. Initial Operational Test and Evaluation objectives for operational effectiveness during this phase are: (1) measure the expected number of kills per pass against armored company arrays, (2) estimate Wide Area Antiarmor Munitions performance in various battlefield and countermeasures environments, (3) estimate operational reliability, and (4) estimate the effect of target location error. The operational suitability objectives include determining the availability, maintainability, reliability, and logistics supportability of the systems. No unique suitability problems are anticipated. Test assets used during Full Scale Development, Development Test and Evaluation/ Initial Operational Test and Evaluation will be soft tooled items which are representative of production items. One hundred and two (102) Antiarmor Cluster Munition test assets are programmed for separate Initial Operational Test and Evaluation. At this time specific subsystems and support equipment requirements have not been identified.

3. Systems Characteristics:

Characteristics for the concept will be definitized during FY81. The objective of the program is to develop a system that can achieve multiple kills per pass of massed armor targets. The development goal is

(779)
(780R)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2550	Laser MAVERICK	1,000	-0-				63,850
2551	Imaging Infrared	50,900	36,300	10,900	5,400	600	167,000
2552	Alternate Warhead	1,668	1,400				21,150
2553	Single Rail Launcher	400					9,600
2555	Common Test Equipment	50	2,500	4,000	200		6,900
2556	Aircraft Integration	82	500				4,600
2676	Infrared Attack Weapon System (IRAWS)	6,000	6,200				12,200

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The USAF and USN must be able to successfully attack small hard fixed and mobile targets such as tanks, armored vehicles, bunkers, and small ships during night and adverse weather. The AGM-65 family of Maverick missiles is being expanded to fill this need. The current deployed television version, AGM-65 A/B, provides an excellent daytime capability against tanks and other similar targets but is not suitable against bunkers or small ships during night or adverse weather. Modular infrared and laser guidance units and an alternate warhead are completing development to fill this need for the close air support, defense suppression and interdiction missions. Specifically, the Air Force as executive agency for the Maverick program is developing: (1) a laser guided Maverick for Marine Corps use; (2) an Imaging Infrared seeker and guidance unit for Air Force and Navy direct attack missiles, AGM-65 D/F; and (3) alternate warhead to expand the Maverick target spectrum. The imaging infrared seeker will also be used on the GBU-15 and Walleye data link weapons. Development of the imaging infrared seeker is being accomplished in a manner which will allow future application of the seeker to the Harpoon weapon system. The Maverick program also includes acquisition of contractor support to accomplish aircraft integration and test of the Maverick weapon system.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The funding requested completes the development and qualification of the support equipment, continues the verification of the imaging infrared missile procurement data package, begins the second source qualification program for the imaging infrared missile; and begins correction of minor problems identified in the imaging infrared missile during the test program. The second source qualification is in preparation for competitive

Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

procurement beginning with the third production increment. The production decision for the USAF imaging infrared version of the Maverick is planned for early FY 1982 following a Milestone III review in late FY 1981.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Total	Total
	Estimate	Estimate	Estimate	Estimate	Additional	Estimated
RDT&E	60,000	40,300 *	14,300		to Completion	Cost
					6,000	282,255

* The FY 1981 R&D request was increased by \$6.2M due to Congressional action to provide for the Navy Infrared Attack Weapon System (IRAWS) by adding the funds requested by the Navy to this Air Force program element. A similar action occurred in FY 1980.

(U) OTHER APPROPRIATION FUNDS:

	FY 1980	FY 1981	FY 1982	FY 1983	Total	Total
	Estimate	Estimate	Estimate	Estimate	Additional	Estimated
					to Completion	Cost

Missile Procurement
(IIR Missiles & Initial Spares)

204,159	357,688	3,672,197	4,234,044
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Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Close Air Support Weapon Systems

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Program Element (PE) 64608F was established to develop improved capability for air-to-surface missiles for use primarily against the massive armor threat of the Warsaw Pact forces in Central Europe. The imaging infrared Maverick provides a common seeker subassembly for Air Force/Navy use with the Infrared Attack Weapon System (IRAWS)*, WALLEYE, Maverick and GBU-15 systems. The imaging seeker extends Maverick capability to night and adverse weather employment while retaining the launch and leave flexibility associated with the television guided Maverick. The Laser Maverick development provides a common laser seeker for a 24 hour attack against Laser designated targets. The advanced warhead development will expand the target spectrum of the Maverick family of weapons to make them effective against earth burdened structures and ship targets. Funding is also provided to support development of common test equipment for all Maverick variants and for aircraft integration.

(U) RELATED ACTIVITIES: The Tri-Service laser seeker developed under this program is being used in the the Marine Corps Laser Maverick missile program. Management responsibilities are delineated in a Joint Development Plan which was approved by the Office of Secretary of Defense. The common infrared seeker subassembly is being developed for GBU-15, WALLEYE, IRAWS and Maverick. Management responsibilities are contained in Memoranda of Agreements between the system program offices. The Navy currently plans to employ the Maverick with their A-4, A-6, F/A-18 and AV-8B and will use the previously developed Maverick single rail launcher. The Air Force plans to employ the imaging infrared Maverick with A-7, A-10, F-4, F-16, and F-111 aircraft. The imaging infrared Maverick missile has also been designated as the primary anti-armor weapon system to be employed with the Low Altitude Navigation and Targeting Infrared System (LANTIRN) and the seeker is being considered for the Navy's Harpoon weapon. Future infrared seeker developments for this class of weapons are constrained by the Office of Secretary of Defense to maintain compatibility with those systems the Maverick imaging infrared seeker is compatible with today as well as the system they are being developed for. An example of this, is the Army's work on focal plane array technology for the next generation of infrared Hellfire missiles. The infrared seeker is required to be compatible with the Maverick missile thereby eliminating duplication of effort by the Army and Air Force in focal plane array infrared technology.

(U) WORK PERFORMED BY: This program element is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The Armament Division, Eglin AFB, FL is the Responsible Test Organization and the Air Force Test and Evaluation Center, Kirtland AFB, NM serves as the Operational Test Agency. Prime contractors are Hughes Aircraft Corporation, Canoga Park, CA, and Rockwell International Corporation, Anaheim, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Full-scale engineering development of Laser Maverick was initiated in July 1975. Contractor flight testing was initiated with Block I laser seeker hardware in January 1976 and consisted of five successful free flight launches. A cost reduction effort was initiated to drive the laser seeker cost toward an Army design to cost goal of \$4300 (FY 1975), for the HELLFIRE application. Phase I of the cost reduction effort which completed in Jan 1978 identified seeker changes that offer significant possibility for cost savings through engineering changes. Contractor flight test of missiles with Block II seekers was initiated in September 1977 and completed during April 1978 after launching 10 missiles. Combined DT&E/IOT&E was initiated during May 1978. Testing was suspended in August 1978 to save the remaining test assets for Navy/Marine Corps peculiar test requirements.

* Navy version of imaging infrared Maverick.

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Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Close Air Support Weapon Systems

Budget Activity: Tactical Programs, #4

Of the 22 missiles launched, impacted the intended target. During August 1978, the Air Force terminated plans to procure Laser Maverick, and the program was restructured to initiate configuration changes peculiar to Marine Corps/Navy use. The changes included the low cost laser seeker, the alternate warhead, and an out of line safety device for the rocket motor. A Defense Systems Acquisition Review of the imaging infrared (IIR) Maverick advanced development program in September 1976 led to a decision by the Deputy Secretary of Defense to transition the program to full-scale engineering development. A Joint Operational Test and Evaluation (JOT&E) during Jan and Feb 1977 assessed the system's utility in a scenario representative of Central Europe. The Joint Operational Test and Evaluation demonstrated the Air Force concept of deductive target recognition. This concept allows target detection, recognition, and missile launch from stand-off ranges with exposure times which result in acceptable attrition rates from Warsaw Pact defenses. The House Armed Services Committee in August 1977, concurred with expenditure of FY 1977 funds to continue advanced development of the IIR seeker and to support testing of the digital centroid tracker. These tests were initiated in November 1977 at Ft Polk and were completed in February 1978 in West Germany. The European tests again demonstrated the capability of flight crews, using normally available target information, to navigate to designated geographic locations, locate the target area, transition to the attack phase of flight and successfully attack armor targets. The capability of the digital centroid tracker to maintain lock-on to valid targets against a thermally cluttered background was demonstrated. Office of the Secretary of Defense/Under Secretary of Defense Research and Engineering reviewed the imaging infrared program and the previous Defense Systems Acquisition Review Council II decision during October of 1978. This review led to the release of FY 1979 funds to initiate the full-scale development program. The contract was awarded on October 30, 1978. The initial design efforts were completed and the imaging infrared Maverick Preliminary Design Review was conducted in June 1979. Engineering drawings for missile fabrication were released. Contractor support for Maverick integration on the F-16 and F-111 was initiated in FY 1977, and on the Navy A-4M in FY 1978. Engineering development of the Maverick Single Rail Launcher and the Maverick Alternate Warhead were initiated during 1977. Development of the Maverick Alternate Warhead was incorporated into the Laser development program for the Marine Corps. The Single Rail Launcher completed full scale engineering development and a production contract for 1400 launchers was awarded in August 1979. Engineering development of the Laser Maverick for the Marine Corps will be completed with FY 1980 funds currently available. The delay in completion of the Alternate Warhead was due to problems associated with the warhead fuze structural design. These problems have been resolved and the test program resumed in FY 1980. The imaging infrared Maverick Critical Design Review was completed in June 1980. Full scale development testing began in July 1980. The Maverick maintenance concept and support equipment study was completed in FY 1980 and work begun on the development of a common support equipment package for all Maverick missiles. Contract award for the support equipment is planned for December 1980.

2. (U) FY 1981 Program: The FY 1981 funding will complete the development tasks associated with the Alternate Warhead and aircraft integration of the Maverick on the F-16 and F-111. The major effort in FY 1981 is the completion of the infrared Maverick engineering development test program and conduct of the Initial Operational Test and Evaluation program. Thirty four flight launches are planned for the Air Force's combined Developmental Test and

Program Element: #64608F

Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Evaluation/Initial Operational Test and Evaluation and Navy's Operational Evaluation. Also planned during this year are qualification, electromagnetic interference, and reliability test programs. Applicable Maverick test data is being used by the GRU-15 and Walleye programs to prevent duplication of effort. The Navy's operational evaluation has been tailored to use the results of the Air Force test program as baseline. A production readiness review and a functional configuration audit will occur in the fourth quarter of FY 1981. Efforts to develop common ground support equipment will continue and include qualification and reliability testing efforts. Efforts will continue to verify the procurement data package for a second production contract for the Imaging Infrared Maverick. Laser Maverick production engineering for long lead items for Marine Corps will begin.

3. (U) FY 1982 Planned Program: Imaging Infrared Maverick missile development will be completed except for correction of the minor deficiencies found during the test program. The common support equipment development will be completed except for minor changes which will be identified during the support equipment qualification program. The Air Force expects to complete the development of the Navy's variant of the Maverick including completing the Operational Evaluation. Upon completion of the DT&E/IOT&E, a milestone III review will be conducted leading to a production decision and production contract award in mid-FY 1982. A contract will be awarded to qualify a second production source. Current plans are to have the qualification completed in time to compete the FY 1984 production buy between the two qualified imaging infrared Maverick producers. Production of the common support equipment will begin. The Laser Maverick production for the Marine Corps will begin.

4. (U) FY 1983 Planned Program: Residual imaging infrared Maverick development and common test set development will be completed in FY 1983. The second increment of imaging infrared production is planned for FY 1983. The second source qualification program with an initial low rate production and flight test program for a second source rate production is also planned. Initial production for the Navy is planned. Life cycle cost reduction efforts will continue.

5. (U) Program to Completion: FY 1984 funds are required to complete the qualification of the imaging infrared Maverick second production source.

6. (U) Milestones: (See Milestones for Project 2551, Imaging Infrared Maverick)

7. (U) Resources: (See Resources for Project 2551, Imaging Infrared Maverick)

Program Element: #64608F

DoD Mission Area: Close Air Support/Pattiefield Interdiction, #222

Title: Close Air Support Weapon Systems
Budget Activity: Tactical Programs, #4

8. (U) Comparison with FY81 Budget Data: (\$ in thousands)

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Actual	Estimate	Estimate	Estimate	to Completion	Estimated
	60,000	40,300	14,300		6,000	Costs
						282,255

RDT&E

*The FY 1980 and FY 1981 (3600) R&D requests were increased by \$6.0 and \$6.2 million respectively due to Congressional action to provide for the Navy Infrared Attack Weapon System by adding the funds the Navy had requested to the Air Force program element.

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Imaging Infrared (IR) Maverick AGM-65D weapon system is being developed for 24 hour operation to counter the threat of an existing enemy force which has the capability to operate offensively at night and under poor visibility conditions. It will provide enhanced capability during light fog, haze, smog, and dust because of its longer wavelength sensitivity (8-12 microns) by exploiting the thermal signature of the target. As a member of the Maverick missile family, the infrared Maverick has the same "launch and leave" capability as the AGM-65 and retains the demonstrated system reliability, high single-pass kill probability and flexibility of employment. The infrared seeker replaces the television seeker on the AGM-65A/B airframe using the existing mounting provisions.

Background Engineering Tests

(U) General. The concept of an imaging infrared guidance system was evaluated by the Night Owl studies in 1970 and 1971. From this study, the Imaging Infrared Guidance and Control Sections were developed. These units have been extensively tested from 1973 to present time. Over 460 captive sorties have been flown. The test results are discussed in the following paragraphs.

Captive Flight Tests. A captive test program was flown during 1974 using hardware developed from the studies. A total of 81 data sorties were flown. Targets for these sorties were tanks, vehicles, ships and radar sites. The tests included passes against a moving and static Soviet T-62 tank from front, rear and right and left side aspects. Recorded lock on ranges varied from

The results of the captive flight test demonstrated the system's aim point and tracking capability. The results quantified detection and lock-on ranges as well as the atmospheric effects on performance and established the base for design improvements. A follow-on captive flight test program was conducted in 1975. During this evaluation, a total of 38 sorties (83 hours) were flown. The targets included power plants, hangarages, and special radar targets. Like the first captive tests, these tests were flown at locations throughout the United States, including New Mexico, the northern Gulf Coast of Florida, and southern California. These tests further quantified detection and lock-on ranges, the atmospheric effects on performance and contributed to design improvements for application to both the Free Flight Advanced Development and Engineering Development Program. An infrared Countermeasures Static Test was performed in conjunction with the follow-on captive flight tests. These tests performed by the Office of the Test Director for Joint Services Guided Weapons Countermeasures Test Program at White Sands Missile Range. The objectives of these tests were to determine the susceptibilities and limitations of seeker and guidance unit in a countermeasures environment. Static tests were conducted using nine different countermeasure devices installed or employed on or near a parked tank target. The static test results provide a data base sufficient to optimize the utilization of resources required for future captive flight tests to evaluate the missile's susceptibility to countermeasures.

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

(U) Free Flight Demonstration. The Free Flight Advanced Development Program was conducted at Eglin Air Force Base, Florida, from July 1975 - December 1975. The objectives of this program were to:

Evaluate the ability of the seeker to maintain target lock-on during launch transient.

Evaluate the missile's tracking capability after launch.

Evaluate the missile's capability to hit typical close air support targets.

Obtain data on seeker/missile system performance.

A total of 57 sorties were flown during this evaluation, 24 F-4 sorties and 33 helicopter sorties. Four missile launches were accomplished during this program. Three of the four resulted in hits.

On launches No. 2 and 4 there were multiple targets in field of view. Launch No. 4 missed the target due to a tracker design deficiency. This problem has been corrected by incorporation of a digital centroid tracker.

European Tower Tests. During February and March 1976, the Imaging Infrared Guidance units were statically tested at Grafenwohr, Germany, in conjunction with the Army's Phase II Imaging tests conducted at the same site. A Television (AGM-65B) guidance unit was also used during this test in order to obtain comparison data between the guidance units during low visibility daylight conditions. During the tests, the performance of the infrared guidance unit was assessed qualitatively against tactical close air support targets under European atmospheric conditions during both day and night. Lock-on to all aspects of a T-62 tank, Moving and static, (range limits). The test data obtained shows good correlation with infrared guidance unit data, target signature data, meteorological data and spectral transmission data from previous test programs. The Infrared Guidance and Control Section showed enhanced target detection over television in degraded visibility conditions.

(U) Digital Centroid and Terminal Correlation Tracker Demonstration. In late 1975, a new tracker for Infrared Maverick was developed. This tracker uses digital centroid tracking for long ranges and correlation tracking at terminal ranges. Helicopter flight tests using this tracker were conducted in February 1976 at Camp Pendleton, California. The purpose of using a helicopter test aircraft was to permit better investigation and evaluation of the terminal correlation portion of the guidance unit while simulating the trajectory of the missile. The objective of this test was to demonstrate the feasibility of the tracker concept and to obtain as much development data as possible. Small tactical targets as well as large stationary targets were used during this test. These tests were very successful and verified the engineering development tracker design.

Budget Activity: Tactical Program, #4
Program Element: #64608F, (Close Air Support Weapons Systems)

Applications Tests. During May and June 1976, tests were conducted in Florida to demonstrate operational applications of the Infrared Maverick weapons system. The objectives of this evaluation were to demonstrate the autonomous night capability of the system against large pre-briefed targets, to demonstrate the capability of Infrared Maverick to detect and attack targets during daylight hours when television weapons are limited (fog, haze, dust, limited contrast), and to demonstrate capability against a wide variety of tactical targets such as camouflaged vehicles and multiple targets in the field-of-view.

Infrared Maverick Joint Operational Test and Evaluation. In the Defense Systems Acquisition Review Council II decision on Infrared Maverick dated 19 November 1976, the program was approved to transition to Full Scale Engineering Development.

(U) The test consisted of captive carry and simulated launch of Advanced Development missiles on A-7 and A-10 aircraft. The newly designed digital centroid and terminal correlation tracker was not used in this test since only a breadboard tracker existed. No missiles were fired. A total of 23 missions (105 data passes) were flown against two ground scenarios. Each pass was structured to be a first pass attack. The two scenarios that attacks were made against were a close air support scenario and pre-planned interdiction scenario. Using current tactics, procedures, and on-board systems, the test demonstrated that transition is not a problem for the conditions tested. The pilots used realistic Forward Air Controller information and on-board navigation systems to navigate accurately from the Initial Point to a pop-up point, the point of transition from navigation to attack. Closely related to the issue of transition, the test demonstrated that current tactics, procedures, on-board navigation systems, and visual battlefield activity provide sufficient cueing information for target area acquisition and target detection. The test demonstrated that valid targets can be selected from a target array containing substantial thermal clutter. It emphasized the importance of proper ground training and practical experience in interpreting thermal signatures. It was also demonstrated that the Infrared Maverick can also be employed effectively on single-seat aircraft. Single-seat employment was successful both day and night in limited visibility conditions of rain, fog, haze, and blowing dust, and heavy battlefiled smoke.

(U) Infrared Maverick Helicopter Tracker Tests. Tests of the new digital tracker were conducted in December 1977 at Camp Grayling, MI and in January at Ft Polk, LA. For these tests the tracker was mounted on a helicopter. Tests at Camp Grayling were used to verify and optimize the digital tracker and to obtain tracker data against targets in a snow environment. The Ft Polk tests were designed to test the tracker against the same scenarios encountered in the February 1976 Maverick test held there. Based on the data available from these tests, the new digital tracker showed a significant improvement in performance over the previous analog tracker.

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

Infrared European Tracker Test. The joint test results prompted Congressional questioning of certain deficiencies as well as concern over the lack of substantive data on the centroid tracker proposed for engineering development. Congress indicated the desire to conduct an operationally oriented captive carry test in European weather conditions. This test was conducted at Baumholder during January-February 1978. Maverick scenarios and profiles tested were similar to those in the joint test. Aircraft involved were A-10 and F-4. One refinement in tactics was to attempt to optimize standoff range versus survivability. Lock-on to all aspects of a tank at approximately was demonstrated. Results demonstrated that the infrared guidance unit (of the type proposed for engineering development) could be successfully employed in European winter weather conditions against both glide weapon and Maverick targets.

(U) Phase I, Infrared Maverick Helicopter Tracker Engineering Development Program. Phase I of the tracker development testing was conducted during July 1979 to February 1980 as part of the engineering development program. Testing was conducted using an advanced development guidance unit and developmental tracker hardware mounted on a helicopter. The main objectives were to: (1) provide a test bed for developing, refining, and evaluating tracker software algorithms and (2) to obtain additional video data for tracker software development of Maverick and glide weapons. The following chart summarizes Phase I of helicopter testing:

(U) Phase I, Engineering Development Helicopter Tracker Tests

<u>DATE</u>	<u>LOCATION</u>	<u>ACCOMPLISHMENTS</u>
July/August 1979	Dugway Proving Grounds	Tank and gunflash signature data in hot/dry climate, uncluttered desert background.
November 1979/January 1980	Eglin Air Force Base, FL	Tank and gunflash signatures in humid climate, low-medium clutter
January 1980	Redstone Arsenal	T-62 tank and T-62 tank simulator signature comparison, low and high thermal heating, low-medium clutter
February 1980	Ft Riley, KS	Armor and tank gunflash signatures in winter (snow) weather, low-medium clutter

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

(U) Current Test Program. The Infrared Maverick weapon system will have a combined test program which will be conducted in accordance with Air Force Regulation 80-14. This program began July 1980 and will continue for 15 months. It will involve the launch of up to 34 missiles and include at least 120 captive flights. All test missions (captive and launch) will be flown by Air Force personnel. Data collected from every test mission will be available to all participating organizations for their evaluation. The purpose of the combined test is to:

Evaluate capability in limited visibility and night operations.

Evaluate lock-on and tracking capability.

Evaluate accuracy and trajectory characteristics within the specified launch envelope.

Evaluate reliability, maintainability, availability.

Evaluate military operational suitability and effectiveness.

(U) A total of 34 missiles will be delivered by Hughes Aircraft Company. Five missiles will contain warheads and 29 will be equipped with telemetry units. Captive flight testing using helicopter and fixed wing aircraft will be conducted to evaluate all aspects of system operation short of missile free flight. Test data will be obtained on target acquisition, seeker lock-on and tracking, system interoperability, reliability, maintainability, availability and logistic supportability. The live firing program will provide additional data and verify the missile's launch transient survivability, free flight performance, and terminal accuracy.

(U) Development Test and Evaluation. A minimum of 16 missiles will be launched and a minimum of 64 effective captive carry sorties will be flown during this test to satisfy primary objectives. An Air Force Preliminary Evaluation will be based on test results from five launches against Air Force specified test parameters defined in the Weapon Systems Specification. These launches are intended to demonstrate the compliance of delivered hardware with contractual performance requirements. Eleven launches are currently planned to satisfy primary objectives by verifying performance requirements and evaluating missile capabilities in various day/night environments against tactical targets. Missile captive flights and launches will be supported with extensive computer simulation of each launch condition and post mission comparison of test results with predicted results. Prelaunch helicopter missions will also be flown to assess guidance performance for each respective scenario and to provide simulation verification, especially with regard to terminal performance. Special emphasis will be placed on obtaining airborne and ground thermal measurements of each target/background scenario. These data will be used to characterize each scenario and mission profile with respect to observed target/background. Extensive atmospheric weather measurement will also be made during each captive-carry and free flight mission to provide a data base for evaluating the performance of the system during varying weather conditions. An assessment of adverse weather capabilities of the infrared missile will be based upon data gathered at

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

three different test locations over a wide spectrum of climatic conditions. Special emphasis will be on exercising the infrared system at Fort Riley, Kansas during the winter months and under realistic tactical employment conditions. The data gathered from captive-carry, and free-flight testing will be subject to the limitations imposed by range and test safety constraints. Therefore, a supplemental adverse weather assessment is planned. This program will involve tower testing of an infrared missile over an extended period of varying atmospheric conditions. The objective will be to study and quantify the acquisition and lock-on performance of the infrared system.

(U) Development Test and Evaluation. Flight Test Objectives. Air Force Development Test and Evaluation objectives will be satisfied by accomplishing a combination of helicopter, captive-flight, and freeflight (launch) testing. These test data will be supplemented and supported by extensive six-degree-of-freedom computer simulations, hardware in the loop simulations, and guidance unit tower testing. Specific Objectives are divided into helicopter, captive-flight and free-flight objectives.

(U) Helicopter Tracker Tests

(U) Evaluation terminal tracking characteristics of the missile against tactical targets and backgrounds in a broad spectrum of atmospheric conditions.

(U) Gather data on tactical target signatures, characteristics, and backgrounds.

(U) Evaluate tracker performance.

(U) Captive Flight Tests.

(U) Verify missile, launcher and carrier aircraft electrical and mechanical compatibility in a prelaunch environment.

(U) Verify weapon system ability to meet specification requirements in terms of target acquisition, operational modes, missile lock-on and tracking capability against targets at or above the specified size and temperature differential in a variety of low to high cluttered backgrounds.

(U) Collect data on captive flight environment effects (temperature, vibration, pressure, humidity, sun exposure, etc.) on the missile and its subsystems.

(U) Evaluate missile video output (display).

(U) Evaluate the accuracy and operational usability of missile bore-sight and missile slaving.

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

- (U) Collect failure data for support of reliability and maintainability analysis.
- (U) Demonstrate compatibility with the electromagnetic environment of the carrier aircraft.
- (U) Evaluate human performance factors in the operation of the system.
- (U) Determine that planned mission parameters are compatible with test aircraft, missiles, and test ranges before free-flight launches are undertaken.
- (U) Free-Flight Launches.
 - (U) Evaluate the ability of the missile to maintain lock-on from launch to impact during day or night against a variety of specified targets in differing atmospheric conditions and backgrounds.
 - (U) Verify and demonstrate the system meets requirements such as:
 - (U) Acoustical noise and vibration
 - (U) Missile operating envelopes
 - (U) Tracking capability
 - (U) Acquisition capability
 - (U) Preparation and missile ready time
 - (U) Boresight alignment
 - (U) Probability of hit

In addition to flight test program previously described, the Air Force will conduct environmental, electromagnetic, reliability, and acceptance testing of the infrared Maverick missile. The Air Force will also integrate the seeker into the on-going program for Thermal Signature Measurement and Environmental Effects (a study of atmospheric effects or infrared system and techniques).

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

2. (U) Initial Operational Test and Evaluation of Infrared Maverick. The operational portion of a combined test is scheduled to commence November 1980 and last through September 1981. The operational test will be managed by the Air Force Test and Evaluation Center with the participation of Tactical Air Command, Air Force Logistics Command, Air Weather Service, Air Training Command, and the Army. The test will provide data for an early, independent assessment of operational suitability and effectiveness of the weapon system. The test missiles will be full scale engineering development hardware representative of the production version. Testing to satisfy operational objectives will require approximately 83 captive missions and at least 10 valid missile launch missions from F-4, F-16, A-10, and F-111 aircraft aircrews and maintenance personnel from the Tactical Air Command will operate and maintain the system during test which is to be conducted at Eglin Air Force Base, Florida; Fort Riley, Kansas; the Naval Weapons Center, California and the Utah Test and Training Range. About one-half of all missions will be flown at night.

(U) Major operational test milestones include the following:

<u>EVENT</u>	<u>DATE</u>
Testing at Eglin Air Force Base	November - December 1980
Testing at Fort Riley	January - March 1981
Testing at Utah Test and Training Range	April - August 1981
Testing at Naval Weapons Center	July - August 1981
Defense Systems Acquisition Review Council III	September 1981

(U) Operational test objectives are:

(U) Operational effectiveness objectives.

(U) Objective 1. Assess the operational performance capability of the weapon system against tactical type targets under day and night conditions.

(U) Objective 2. Evaluate missile compatibility with other on-board aircraft systems.

(U) Objective 3. Assess missile interoperability with other systems.

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Budget Activity: Tactical Programs, #4

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- (U) Objective 4. Assess the survivability of the delivery aircraft during weapons delivery.
- (U) Objective 5. Assess the accuracy and suitability of weather forecast techniques as a potential aid for operational employment decisions for the weapon.
- (U) Operational suitability objectives.
- (U) Evaluate the reliability, maintainability, and availability of the missile.
- (U) Evaluate the logistics supportability.
- (U) Evaluate suitability of software.

(U) Planned missile firings for test (subject to change) include:

<u>Aircraft</u>	<u>Day/Night</u>	<u>Target</u>
F-4E	Day	Mobile Artillery
A-10	Day	Tank
A-10	Night	Tank
A-10	Night	Tank
F-111F (Pave Tack)	Day	Fuel Storage Facility
*F-16	Day	Tank and Armored personnel carrier
F-4G	Night	Simulated ZSU-23-4
F-111F (Pave Tack)	Night	Tank
F-16	Night	Armored personnel carrier

* Dual launch

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Budget Activity: Tactical Programs, #4

Program Element: #64608F, (Close Air Support Weapons Systems)

(U) A major portion of the test will be dedicated to the reliability, availability, and maintainability evaluation including all associated support and test equipment. Air Force maintenance and handling personnel will perform pre-flight and postflight checkout, uploading, downloading, and all maintenance possible using preliminary technical manuals provided by the Hughes Aircraft Company. Approximately 160 hours of captive-carry flight time will be accumulated for evaluation of these test items.

(U) Current planning calls for all testing to be completed prior to the production decision. Follow-on Operational Test and Evaluation test dates have not been established.

(U) The missiles to be tested are of the same configuration and are representative of the intended procurement configuration except that warheads in eight of the ten missiles have been replaced by telemetry units to facilitate missile performance data collection. Additionally, Initial Operational Test and Evaluation missiles will not be configured with the reduced smoke rocket motor which is not expected to affect overall test results.

3. (U) The Imaging Infrared Maverick missile will have the following major performance characteristics demonstrated during the test program.

(U) Prelaunch reliability of .935 $\frac{1}{1}$

(U) Launch reliability of .985 $\frac{2}{2}$

(U) A target impact probability of .87 $\frac{3}{3}$

(U) Useful life of 10 years $\frac{4}{4}$

$\frac{1}{1}$ (U) Prelaunch Reliability is defined as the probability that the system, launcher and missile, will survive for the period from checkout through all mission phases up to initiation of missile launch, given that the system was operable when checked out. Pre-launch reliability will be determined from the actual launch missions and approximately 120 captive carry missions.

$\frac{2}{2}$ (U) Launch Reliability is defined as the probability that a missile will launch and perform inflight guidance, arming, and detonation, given that it had been malfunction free during prelaunch. Launch reliability will be determined by test data and analysis.

$\frac{3}{3}$ (U) Test Impact Probability is the probability of hit given a malfunction free launch and guidance phase. It is determined by combining flight test results, six degree of freedom Monte Carlo simulations (random error sources and a Monte Carlo performance model for deterministic errors. The accuracy of this method has been substantiated by experience with the AGM-65A/B.

$\frac{4}{4}$ (U) The 10 year useful life is a design requirement and is supported by the AGM-65A/B experience with the continuing age out program accomplished by Air Force Logistics Command.

Project: # 2551

Program Element: #64608F

Title: Imaging Infrared (IIR) MAVERICK
Title: Close Air Support/Battlefield Interdiction, #222
DoD Mission Area: Close Air Support/Battlefield Interdiction, #222
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Development under this project will provide a common imaging infrared (IIR) seeker subassembly for Joint Navy and Air Force use with the WALLEYE, Infrared Attack Weapon System (IRAWS), Maverick and GBU-15 systems. The technology developed may be transferable to other infrared efforts. Imaging infrared seeker/guidance technology will provide 24 hour adverse weather capability across a wide target spectrum for both direct and indirect attack weapons. The imaging approach provides for maximum system flexibility and utility with the largest number of attack aircraft because it is not dependent on a Forward Looking Infrared acquisition device. It can be used autonomously or with any acquisition device which will provide an azimuth and an elevation pointing signal. The imaging infrared seeker when integrated with Maverick will provide a direct attack capability for the 1980s which no other system currently planned or in inventory can offer.

(U) RELATED ACTIVITIES: Imaging infrared has been a Joint Air Force/Navy development since 1973. Program management has been accomplished through a formal Memorandum of Agreement between the Maverick Program Office and the Naval Avionics Center at Indianapolis, IN. Management of the effort necessary for the GBU-15 application is being accomplished through a formal agreement with the GBU-15 Program Office at Eglin AFB, FL. A formal charter between the Aeronautical Systems Division (AFSC) and the Naval Air Systems Command has been signed for the development of Joint Air Force/Navy Maverick developments. The imaging infrared seeker/guidance unit is designed to be compatible with target acquisition systems which can provide azimuth and elevation pointing signals. These currently include the Navy TRAM POD and the Air Force's PAVE TACK, PAVE PENNY and Wild Weasel APR-38 systems. The imaging infrared Maverick missile has also been designated as the prime anti-armor weapon system to be employed with the Low Altitude Navigation and Targeting Infrared System.

(U) WORK PERFORMED BY: The imaging infrared Maverick Program is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH, and the Naval Air Systems Command, Wash, DC. The Armament Division, Eglin AFB, FL, is the responsible Test Organization and the Air Force Test and Evaluation Center, Kirtland, AFB, NM, serves as the Operational Test Agency. Navy peculiar system tests will be performed by the Naval Avionics Center and the Naval Weapons Center, China Lake, CA. Hughes Aircraft Corp, Canoga Park, CA who have won three separate competitive source selections as the program evolved to the Advanced Development stage, is the prime weapon system contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The imaging infrared (IIR) Maverick advanced development was completed in December 1975 under Program Element (PE) 63601F (Conventional Weapons). Preliminary engineering development planning and studies were initiated under PE 64608F in FY 1975. This effort included aircraft interoperability testing on the F-4 Wild Weasel, F-4 PAVE TACK, and A-7 aircraft in operational scenarios, and has included night and autonomous visual operations. The imaging infrared guidance unit was evaluation side-by-side with the TV Maverick guidance unit in Germany during February and March 1976. This test demonstrated the utility of imaging infrared Maverick in the winter

Project: # 2551

Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Imaging Infrared (IIR) MAVERICK

Title: Close Air Support Weapon Systems

Budget Activity: Tactical Programs, #4

European weather environment. An extensive producibility effort was initiated to insure that critical guidance unit components could be manufactured at high rates and would meet shelf-life requirements. Accelerated life cycle testing on key components has demonstrated that 10-year shelf-life requirements can be met. A Milestone II Program Review was accomplished by Office of the Secretary of Defense (OSD) in September 1976 and resulted in a Deputy Secretary of Defense decision to transition the program into full-scale engineering development. A Joint Operational Test & Evaluation (JOT&E) was accomplished during January and February 1977. This JOT&E demonstrated the capability of crew members in single seat aircraft to detect and recognize valid targets and launch a missile at slant ranges which would result in acceptable attrition from ground based defenses. The JOT&E was accomplished using advanced development hardware with edge tracking logic which is susceptible to break locks due to thermal clutter. This fact was recognized by the Air Force in early 1975 and design efforts were started by Hughes Aircraft to develop a digital centroid tracker. The digital tracker was captive flown with a helicopter during 1976 and the test results were reviewed by the OSD Deputy Director for Test and Evaluation during the Milestone II Program Review process. The digital tracker was tested in Europe during January and February 1978. The tracker maintained lock-on to valid targets against operationally realistic thermal background clutter with a success rate. Prior to the European tests, the Air Force had identified computer software changes to be made to the engineering development guidance unit which we estimate will improve the lock-on tenacity success rate to . Analysis of the European test results further indicated that, even with a perfect tracker, there would have been an break lock rate. OSD/Under Secretary of Defense Research and Engineering reviewed the imaging infrared program and the previous Milestone II decision during October 1978. This review led to the release of FY 1979 funds to initiate the full scale development program and the contract was awarded on October 30, 1978. Engineering design efforts have been completed and a Preliminary Design Review (PDR) was held in June 1979. Additionally, fabrication and testing of prototype tracking algorithms and tracking gate changes are being combined with countermeasures hardening techniques in prototype hardware and are being tested via helicopter captive flight testing. Efforts to complete the special test equipment have concluded and laboratory tests to verify tracker sensitivity and detector scanning improvements are presently being conducted. The Navy and Air Force completed the engineering definition of changes needed to satisfy Navy IRAWS requirements. Testing of full up guidance units was started during the first quarter of the FY 1980. This was the first time that all the proposed changes were incorporated in a single unit for systems engineering testing and flight simulations. The second series of helicopter captive flight test and aircraft captive flight test of all up missiles began during the third quarter of the fiscal year. The imaging infrared Maverick Critical Design Review was conducted during June 1980 followed by the initiation of contractor flight testing. Contractor flight testing was completed during the last quarter of FY 1980 as government flight testing phased in.

2. (U) FY 1981 Planned Program: The FY 1981 program will focus on the combined Development Test and Evaluation/Initial Operational Test and Evaluation Program (DT&E/IOT&E). Delivery of test missiles will be completed during the second quarter of FY 1981. The flight test phase of this program has been initiated at Eglin AFB. Testing will also be conducted under winter conditions at Ft Riley, Kansas and under desert conditions at the Utah Test and Training Range

Project: # 2551

Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Imaging Infrared (IIR) MAVERICK

Title: Close Air Support Weapon Systems

Budget Activity: Tactical Programs, #4

and Naval Weapons Center at China Lake in California. Systems Qualification, Electronic Interference and Reliability testing will be conducted during FY 1981. The software for the Navy version of the Infrared (IR) Maverick will be developed and Navy Development Test and Evaluation of this software package will be initiated. The Navy will also evaluate data from Air Force DT&E/IOT&E to ascertain their readiness to enter Navy Operational Test and Evaluation. Evaluation of the data base for competitive production sourcing will be accomplished. The effort to develop a test set to checkout the Maverick Family of missiles will be initiated.

3. (U) FY 1982 Planned Program: The funds requested for FY 1982 will be used for completion of the Infrared (IR) Maverick full scale development program including Functional Configuration Audit and Production Readiness Review. Residual testing efforts and analysis of that data will be completed with a Milestone III review and production decision. Life Cycle cost reduction efforts will be continued. Verification and proof of the Infrared (IR) procurement data package will be continued. Development of the Maverick missile family test set will continue. Qualification of a second production source will begin. The increase in the budget estimates for FY 1982 and FY 1983 are due to changes in the escalation index. The change in total program cost is due to increased production quantities.

4. (U) FY 1983 Planned Program: Residual imaging Infrared Maverick development and common test set development will be completed in FY 1983. The second increment of imaging Infrared production for FY 1983 and the second source qualification program with initial low rate production and flight test working toward second source rate production are planned for FY 1983. Life cycle cost reduction efforts will continue with emphasis on the training missile.

5. (U) Program to Completion: FY 1984 funds are required to complete proof of the imaging Infrared Maverick procurement data package. This effort will determine suitability of the package for competitive procurement from industry.

6. (U) Milestones:

A. Defense Systems Acquisition Review Council II	September 1976
B. European Test Complete	February 1978
C. Full Scale Development Initiated	October 1978
D. Initiate Helicopter Flight Tests (Changes to tracker algorithms)	June 1979
E. Engineering Development Model Delivery	May 1980
F. Critical Design Review	June 1980
G. Initiate DT&E/IOT&E	June 1980
H. Complete DT&E/IOT&E	September 1981
I. Production Readiness Review	First Quarter FY 1982
J. Milestone III and Production Decision	First Quarter FY 1982

Project: # 2551

Program Element: #64608F

DoD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Imaging Infrared (IIR) MAVERICK

Title: Close Air Support Weapon Systems

Budget Activity: Tactical Programs, #4

7. (U) Resources: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RD&E	50,900	36,300	10,900	5,400	600	167,000
Missile Procurement (Missiles & Initial Spares) (Quantity)			204,159 (490)	357,688 (3,660)	3,672,197 (56,514)	4,234,044 (60,664)

8. (U) Comparison with FY 1981 Budget Data:

RD&E	36,300	13,300	6,000	165,100
Missile Procurement (Missiles & Initial Spares) (Quantity)		196,000 (490)	2,098,627 (32,030)	2,294,584 (32,520)

(800)

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64612F

Title: Low Level Laser Guided Bomb
Budget Activity: Tactical Programs, #4

DoD Mission Area: Interdiction/Naval Strike, #223

RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	8,000	4,900 ^{1/}	8,500	4,200		29,335

2657 Low Level Laser Guided Bomb

- 1/ The FY 1981 Authorization Conference has directed that this funding support a Navy approach to modify inventory laser guided bombs in addition to this Low Level Laser Guided Bomb program.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Current laser guided bombs cannot be accurately delivered from the extremely low altitude required for acceptable aircraft attrition in the presence of significant surface to air threats. In addition, limitations on acquisition field of view and sensitivity, and on bomb maneuverability restrict the delivery envelope of current laser guided bombs. The Low Level Laser Guided Bomb is an improved laser guided bomb which greatly expands the delivery envelope including low altitude level launch from altitude. The Tactical Air Forces require the tactical flexibility, accuracy, and reduced attrition provided by the Low Level Laser Guided Bomb.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Funds fabrication of Low Level Laser Guided Bombs for testing and the start of initial operational test and evaluation. Ensures availability of necessary numbers of "full-up" Low Level Laser Guided Bombs and related spares and checkout equipment to enable a thorough assessment of operational utility and exploration of the full delivery envelope. Ensuing operational testing will be conducted by the Air Force Test and Evaluation Center. Funds qualification testing and detailed engineering and reviews to ensure readiness for production. Cost estimates are based upon the fully negotiated firm fixed price contract option with the development contractor plus Air Force estimates of funding requirements to initiate Air Force operational testing.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Procurement	8,000	9,000	4,500			25,235

Procurement not included in FY 1981 summary.

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Program Element: #64612F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Low Level Laser Guided Bomb

Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
Procurement (Other)(PE#28030F)			17,500	120,300	TBD	TBD
(Quantity)				(2,000)	(TBD)	

Project Number: #2657

Program Element: #64612F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Low Level Laser Guided Bomb

Title: Low Level Laser Guided Bomb

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This program is to extend our laser guided bomb delivery capability down to altitude and extend the acquisition, maneuverability, and accuracy as demanded by weather and defensive environments in Europe. The Tactical Air Forces need the versatile effectiveness of the laser guided bomb to attack the bridges, depot and airfield facilities, fixed radar installations, and structures of all kinds that are too large for an antitank munition and too numerous for the GBU-15. The laser guided bomb showed in Southeast Asia an advantage of from to as much as

increase in effectiveness over unguided weapons, at a very low cost. The Production Engineering Program improved reliability, shelf life, handling, etc, but left performance essentially unchanged. With inventory laser guided bombs, minimum release altitude required for specified accuracy is depending on airspeed and other parameters. Loft delivery tactics have been developed recently to provide some low altitude capability with the Production Engineering Program Laser Guided Bomb, but, under those conditions, accuracy is degraded by a factor of

While low altitude delivery increases the survivability of the delivery aircraft, it increases the terrain masking of most land targets. As a result, the laser guided bomb must possess the capability to rapidly acquire the laser energy following launch and the maneuverability to fly to the target over a wide footprint. As compared to current laser guided bombs, the Low Level Laser Guided Bomb incorporates an enlarged seeker field of view and improved seeker sensitivity to provide effective acquisition of laser energy under reduced visibility conditions. The larger airfoils, proportional control, microprocessor logic, and proportional guidance of the Low Level Laser Guided Bomb provide increased range, maneuverability, and accuracy. These improvements provide the delivery aircraft tactical flexibility. This improved laser guided bomb can be launched at low altitude and successfully acquire and fly to the target under visibility conditions common to Europe from the range limits at which the target can be identified and designated. Using "buddy" designation, even greater standoff is provided the delivery aircraft. In sum, the Low Level Laser Guided Bomb will improve our ability for accurate delivery of ordnance while reducing attrition of the delivery aircraft. The Low Level Laser Guided Bomb system consists of a conventional warhead, a laser bomb guidance kit, support equipment, and special tooling. The laser bomb guidance kit, consisting of an airfoil group and a guidance and control unit, is installed on an appropriate warhead to provide a guided weapon capability against laser designated targets. Primary emphasis will be on the MK-82 (500 lb) and MK-84 (2000 lb) bombs; however, the Low Level Laser Guided Bomb kit can be compatible with the MK-83 (1000 lb) bomb and adaptable to the Hard Structure Munition Warhead. Two concept studies and a recent Design to Cost evaluation have shown that these new capabilities can be obtained at only a small increase in Laser Guided Bomb unit cost. No modifications to aircraft are necessary to provide the Low Level Laser Guided Bomb drop capability since no electrical interface is required between the aircraft and the Low Level Laser Guided Bomb. The Low Level Laser Guided Bomb will be designed for compatibility with the F-4, F-16, F-111, A-7, and A-10 aircraft. Laser designation will be performed by the delivery aircraft, by another "buddy" aircraft, or by a ground designer dependent upon the tactical situation.

(U) **RELATED ACTIVITIES:** Procurement of the present design Production Engineering Program Laser Guided Bomb kit is continuing under Program Element 28030F (War Readiness Material, Ammunition). A phase-in from that procurement to the Low Level Laser Guided Bomb kits is contemplated for FY 1983 based upon a successful outcome of this development program. In accordance with the direction contained in the FY 1981 Authorization Conference Report, a Navy suggested modification to inventory laser guided bombs is being investigated. The Naval Weapons Center has conducted a basic feasibility demonstration of this "gravity bias" modification for Mk-83 application. In addition, the Air Force and the Navy are undertaking a joint study evaluating the relative benefits of the Low Level Laser Guided Bomb and the Navy proposed modification for effective utilization of laser guided bombs against respective Air Force and Navy targets.

Project Number: #2657

Program Element: #64612F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: Low Level Laser Guided Bomb

Title: Low Level Laser Guided Bomb

Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command (AFSC), Andrews AFB, MD and Armament Division, Eglin AFB, FL. Texas Instruments, Inc., is the contractor for this development.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Concept feasibility studies conducted under Program Element 63601F, Conventional Weapons Technology, were completed in January 1977. Those studies, performed by Texas Instruments, Inc., and Rockwell International Corp., indicated that substantial performance improvement could be realized by changing the seeker, adding an autopilot based on microprocessor technology, modifying the controls, and/or changing fin and wing design. The Air Force tactical operating commands examined those findings and determined that such an improved weapon would meet their requirements, as stated in Tactical Air Forces Required Operational Capability 315-17, published 31 August 1977. In FY 1979, the acquisition program plan was finalized and contracting activities begun. In FY 1980 a competitive source selection process resulted in award of a firm fixed price contract for Phase I of full scale development with a negotiated firm fixed price option for completion of development and test (Phase II) and a Not-to-Exceed price for initial production. Under Phase I, design and prototype fabrication was conducted.

2. (U) FY 1981 Planned Program: Manufacture of the development test and evaluation items will occur. Development flight test will be conducted. Phase II will be initiated to complete development via fabrication of test vehicles and support equipment for operational testing.

3. (U) FY 1982 Planned Program: Fabrication will be completed of full-up Low Level Laser Guided Bombs and related support equipment to allow thorough operational flight testing. Operational testing, conducted by the Air Force Test and Evaluation Center, will be initiated examining the operational employment and utility of the expanded delivery envelope and improved accuracy provided by the Low Level Laser Guided Bomb. Qualification testing will be conducted. Production studies and related efforts will be completed to ensure availability of all data needed for a production decision and readiness for production. Production tooling will be procured via Program Element # 28030F. The increase in current total estimated RDT&E costs from that estimated in FY 1981 is due to: appropriated FY 1981 funding and Congressional direction to investigate the Navy modification proposal; reassessment of costs for initial operational test and evaluation, and inflation adjustment.

4. (U) FY 1983 Planned Program: Complete Initial Operational Test and Evaluation. Obtain production decision and begin production.

5. (U) Program to Completion: Conduct Follow-on Operational Test and Evaluation. Continue production.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64614F

Title: Medium Range Air-to-Surface Missile
Budget Activity: Tactical Programs, #4

DOD Mission Area: Interdiction/Naval Strike, #223

(U) RESOURCES (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT			14,000	49,100	TBD	TDB	TBD

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force, the Office of the Secretary of Defense and the Congress agree that there is a need for an air-launched conventional standoff missile capable of being employed against tactical targets by aircraft of the Strategic Air Command and the tactical air forces. This standoff missile is needed to destroy well protected, high value targets rapidly while minimizing the exposure of launch aircraft to the massive quantity of current and projected enemy lethal air defense systems. Air Force analysis concluded that the optimum solution to this need, based on range, payload, survivability, supportability, growth potential and technical risk assessments, would be met by a subsonic, low flying cruise missile system. The Medium Range Air-to-Surface Missile will satisfy the standoff missile requirement. Congress appropriated \$30 million in FY 1980 and directed the initiation of engineering development of a joint Air Force/Navy air-to-surface standoff missile to be available for production on or before On 27 March 1980, the Office of the Secretary of Defense directed that a variant of the AGM-109 TOMAHAWK be developed "with minimum modification" to satisfy the Joint Medium Range Air-to-Surface Missile need within the timeframe directed by Congress. The Air Force version of the Medium Range Air-to-Surface Missile is known as the AGM-109H.

(U) BASIS FOR FY 1982 RDT&E REQUEST: FY 1982 funds will be used to continue system integration, begun under Navy Program Element 63369N, Medium Range Air-to-Surface Missile, of the following major components into the Air Force version of the Medium Range Air-to-Surface Missile; lower cost strapdown inertial guidance unit, Digital Scene Matching Area Correlator and Tactical Airfield Attack Munition dispenser warhead. Integration of the Medium Range Air-to-Surface Missile into the weapons system of the test aircraft and free flight testing of various subsystems and submunitions will be conducted in FY 1982 leading to the first full system flight of a developmental AGM-109H dispensing runway cratering submunitions against an actual runway type target in FY 1983.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable.

(U) OTHER APPROPRIATION FUNDS (\$ in thousands):

FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
			7,200	CONT (TBD)	TBD (TBD)
Procurement Missile (PE #27164F) (Quantity)					

Program Element: #64614P

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The vast quantities, complementary capabilities, redundancy and ever increasing lethality of newer Soviet surface-to-air defensive systems led the Air Force to assess alternative methods of attacking heavily defended high value targets located deep inside enemy territory. Numerous Service studies, notably the Air Force's Strike Options Comparison Studies, completed in 1978, and Advanced Conventional Standoff Missile studies, published in 1979, as well as the Navy's Tactical Air Capabilities/Options Project of 1977 concluded

were needed to effectively accomplish the tactical air mission now and in the foreseeable future. Additionally the Institute for Defense Analyses conducted an extensive series of studies for the Department of Defense which assessed the potential effectiveness of both aircraft and conventionally armed missiles for deep attacks against the complex of Soviet/Warsaw Pact air bases in Central Europe. In general, these studies all concluded that attacks on such major military target complexes, in the modern high density threat environment which is found in Eastern Europe, would

defense suppression assets and would require the

tactical missions generated in the course of an intensive and fluid land/air battle. In addition, the deeper air base targets could.

NATO's total air strength. The Medium Range Air-to-Surface Missile will supplement conventional direct attack unguided and guided weapons as well as short range air-to-surface and anti-radiation missiles by providing operational commanders an alternative to the commitment of a large force to attack fixed, high value, heavily-defended targets. The ability to attack these targets from beyond the range of effective defenses will enhance aircraft survivability and free tactical aircraft for employment against fluid targets. The Medium Range Air-to-Surface Missile program was initiated as a Joint Services program in FY 1979 at Congressional direction. The principal required system characteristics are: launch range sufficient to remain outside most lethal surface-to-air defenses, autonomous strike capability in adverse weather, effectiveness against land targets, compatibility with both tactical and strategic aircraft and an early operational capability. In March 1980, following analysis of various system options, the Office of the Secretary of Defense decided that a tactical variant of the TOMAHAWK cruise missile provided the greatest return in operational capability at the least investment cost. The Medium Range Air-to-Surface Missile variant of the TOMAHAWK will take advantage of the significant development effort which has been invested in the Joint Cruise Missile Program. The scope of effort needed to develop and deploy the Medium Range Air-to-Surface Missile variant of the TOMAHAWK is limited primarily to a modular adaptation of new warhead and guidance modules to meet specific service requirements and to integration of the missile with various delivery aircraft weapon systems. The Air Force version of the Medium Range Air-to-Surface Missile, AGM-109H, has the primary mission of airfield attack. For this purpose, it is fitted with a dispenser warhead section which carries specialized runway cratering submunitions. Primary Air Force launch aircraft for the Medium Range Air-to-Surface Missile will be Strategic Air Command B-52D bombers and F-16 fighters of the tactical air forces.

Program Element: #64614F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile
Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: This development is supported by related developments in the Sea Launched Cruise Missile (PE 64367N), Air Launched Cruise Missile (PE 64361F) and the Ground Launched Cruise Missile (PE 64362F) programs. The TOMAHAWK airframe, navigation, guidance and mission planning systems were developed under these program elements. Additionally, the Midcourse Guidance Demonstration Project under PE 63601F, Conventional Weapons Technology, is employing TOMAHAWK to flight test new lower cost guidance concepts which will be applied to the Medium Range Air-to-Surface Missile. The Navy portion of this development effort was conducted under PE 63369N.

(U) WORK PERFORMED BY: The airframe for the Medium Range Air-to-Surface Missile is manufactured by the General Dynamics Corporation, Convair Division and the guidance system integrator is McDonnell Douglas, Astronautics Division. The missile turbojet engine is produced by Teledyne Continental Aircraft Engines. Major development agencies for the missile are the Air Force's Armament Division, Eglin AFB, Florida and the Naval Weapons Center, China Lake, California. A number of other commercial and governmental agencies will be involved in subsystem design, development and testing as the development progresses.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: FY 1980 and prior work on the Joint Medium Range Air-to-Surface Missile was conducted under PE 63369N.

2. (U) FY 1981 Program: Initiate ground testing of the Lawrence Livermore designed runway cratering submunition (the VAM-93) against actual runway-type targets to validate the basic design concept. Conduct studies of the response of threat aircraft to various degrees of runway damage to confirm the level of destructive effect which must be achieved. Initiate detailed design and planning for flight testing of VAM-93 submunitions using a special test dispenser from a manned delivery aircraft. Conduct Medium Range Air-to-Surface Missile integration studies to determine the modifications required to integrate the lower cost strapdown inertial guidance system, Digital Scene Matching Area Correlator and the lower cost Teledyne turbojet engine in place of the turbofan engine used in the longer range strategic variants of TOMAHAWK.

3. (U) FY 1982 Planned Program: Complete system integration of the Air Force version of the Medium Range Air-to-Surface Missile using a lower cost strapdown inertial guidance system, Digital Scene Matching Area Correlator and the lower cost Teledyne turbojet engine in place of the turbofan engine used in the longer range strategic variants of TOMAHAWK. Initiate the integration of the Medium Range Air-to-Surface Missile with the B-52D and F-16 aircraft and weapon delivery systems. Conduct a study of transportation, handling and storage requirements for the Medium Range Air-to-Surface Missile in order to define compatibility with existing Air Force support systems and facilities and to define logistics support requirements. Demonstrate compatibility of the Medium Range Air-to-Surface Missile through handling demonstrations and captive flight tests from the B-52D and F-16. Complete development, subsystems integration and testing of the Lawrence Livermore Laboratories designed runway cratering submunition and initiate qualification testing of full-up live rounds against actual runway targets. Complete Tactical Airfield Attack Munition Dispenser design, development, and integration into Medium Range Air-to-Surface missile system. Adapt the existing TOMAHAWK mission planning system for use in conjunction with tactical air operations. Modify the software in the B-52D and F-16, in the mission planning system and in the TOMAHAWK missile to enable performance of the air base attack mission.

Program Element: #64614F

DOD Mission Area: Interdiction/Naval Strike, #223

Title: Medium Range Air-to-Surface Missile
Budget Activity: Tactical Programs, #4

4. (U) FY 1983 Planned Program: Conduct Development Test and Evaluation and Initial Operational Test and Evaluation of the Air Force version of the Medium Range Air-to-Surface Missile to include free flight tests delivering complete patterns of live submunitions against actual runway type targets. Complete system integration of the missile into the weapons delivery system of the B-52D and the F-16. Develop and evaluate additional modular program warhead concepts designed to improve the effectiveness of the Medium Range Air-to-Surface Missile against a wide range of tactical targets.

5. Program to Completion: Complete Development Test and Evaluation and Initial Operational Test and Evaluation leading to approval for service use of the AGM-109H and production decision. Investigate the use of Medium Range Air-to-Surface Missile on other Air Force launch platforms. Evaluate various alternative for use in follow-on Air Force variants to enhance mission effectiveness and reduce cost.

6. Milestone:

Date

- | | |
|---|-----------|
| A. Initiate Joint Full Scale Engineering Development Program | July 1980 |
| B. First Live Flight Test of Cratering Submunition | July 1981 |
| C. First AGM-109H Contractor Test and Evaluation Flight | |
| D. First Air Force Development Test and Evaluation Flight | |
| E. Complete Development Test and Evaluation/Initial Operational Test & Evaluation | |
| F. Production Approval | |
| G. First Production Item Delivered | |

Budget Activity: Tactical Programs, #4
Program Element: #64614F

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Medium Range Air-to-Surface Missile (MRASM) test program is being managed by the Joint Cruise Missiles Project Office. The Air Force version of MRASM is the AGM-109H variant of the TOMAHAWK Missile. General Dynamics, San Diego, California, is the prime integrating contractor.
- (U) MRASM development testing of the TOMAHAWK missile will incorporate test results from the Sea Launched Cruise Missile (SLCM), the Air Launched Cruise Missile (ALCM) and Ground Launched Cruise Missile (GLCM) programs to reduce MRASM test requirements. ALCM, GLCM, and SLCM are all variants of the basic TOMAHAWK design.
- (U) A number of AGM-109 tests and demonstrations have been conducted to date which directly relate to the development of the Air Force version of the MRASM weapon system. These efforts include extensive Development Test and Evaluation efforts in conjunction with the SLCM program. The AGM-109 also participated in the competitive flyoff phase of the Air Launched Cruise Missile competition during which it was launched from a modified B-52G. The ALCM flight test program began in April 1979 with B-52 flutter and jettison tests. The modified B-52G arrived at Edwards AFB, California in May 1979 with actual AGM-109 flight testing running from July 1979 through February 1980. This test program consisted of B-52 performance evaluations with AGM-109s loaded, captive carry testing as required, ten live flights, reliability and maintainability demonstrations, mid-air recovery and survivability and vulnerability testing. The ten AGM-109 flights were further divided into three Development Test and Evaluation flights conducted by General Dynamics and seven Development Test and Evaluation/Initial Test and Evaluation flights conducted by a joint Air Force Development Test and Evaluation/Initial Operational Test and Evaluation test team. Initial Operational Test and Evaluation was managed by the Air Force Test and Evaluation Center.
- (U) Through September 1980, a total of 54 A/BGM-109 TOMAHAWK flight test missions had been accomplished of which 38 were launched from aircraft (both Air Force B-52G and Navy A-6). These missions provided generic cruise missile data applicable to MRASM development in the areas of engine performance, airframe stability and control, navigation/guidance and missile performance.
- (U) A most significant test milestone was the May 1978 AGM-109 mission which demonstrated the feasibility of using the TOMAHAWK/Tactical Airfield Attack Munition dispenser combination to attack runway targets. This

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Budget Activity: Tactical Programs, #4
Program Element: #64614F

mission, launched from an A-6 aircraft and flown over realistic operational ranges, actually delivered dummy runway cratering submunitions. Ten of the twelve submunitions dispensed impacted on the runway target (Michael Army Airfield, Dugway Proving Ground, Utah).

(U) The Air Force version of the Medium Range Air-to-Surface Missile, the AGM-109H, is expected to fly for the first time during fiscal year 1983 with a combined Development Test and Evaluation/Initial Operational Test and Evaluation during the period from mid fiscal year 1983 through mid fiscal year 1984. The Follow-on Test and Evaluation will continue through mid fiscal year 1985. The Air Force Armament Division is the development test agency and the Air Force Test and Evaluation Center is the operational test agency. Most of the developmental flight testing will be conducted at the Utah Test and Training Range and the Eglin Air Force Base, Florida, range complex.

(U) Specific development test and evaluation objectives include verifying vehicle performance, stability and control and propulsion as well as terminal effectiveness of the runway cratering submunition. System effectiveness in accomplishing the mission will be evaluated to include launch, navigation, target acquisition, munitions dispensing and pattern effectiveness. Environmental testing, to include adverse weather tests in the climatic hanger at Eglin Air Force Base, Florida, will also be conducted.

2. (U) Operational Test and Evaluation: The Air Force Test and Evaluation Center will manage the Air Force Operational Test and Evaluation and participate in the Navy's combined Development Test and Evaluation/Operational Test and Evaluation on the Navy variants of the Medium Range Air-to-Surface Missile. Personnel from Strategic Air Command, Tactical Air Command, Air Force Logistics Command and Air Training Command will serve along with Air Force Test and Evaluation Center representatives on the Multi-service Operational Test and Evaluation test team. The Navy's testing is tentatively scheduled for the first three quarters of fiscal year 1983. Air Force combined Development Test and Evaluation/Initial Operational Test and Evaluation and dedicated Initial Operational Testing and Evaluation is scheduled to begin in the fourth quarter of fiscal year 1983 and will continue through the first quarter of fiscal year 1984. The Air Force Test and Evaluation Center managed initial phase of Follow-on Operational Test and Evaluation will be conducted following the production decision, during fiscal years 1984 and 1985.

(U) The Navy test vehicles will be very similar to the Air Force vehicles, allowing a transfer of representative operational test data that can be used as a partial baseline for Air Force operational testing. The Air Force test program will be developed using this data base and will emphasize the differences between vehicles, focusing on the unique operational characteristics of the Air Force's AGM-109H.

(U) Air Force operational effectiveness objectives will stress the Navy and Air Force configuration and mission differences. However, because of differing operational concepts and environments, Air Force operational suitability assessments will be based primarily on Air Force generated data.

Budget Activity: Tactical Programs, #4
 Program Element: #64614F

3. (U) System Characteristics:

Physical Characteristics

General Dynamics AGN-109H

(U) Length (inches)	232
(U) Diameter (inches)	21
(U) Weight (pounds)	2,800
(U) Payload Weight (pounds)	1,000 (58 submunitions)
(U) Useable fuel Weight (pounds)	331
(U) B-52D Internal Carriage (each)	4
(U) B-52D External Carriage (each)	8
(U) F-16 Carriage (each)	2

Performance Data

	<u>Threshold</u>	<u>Goal</u>	<u>Demonstrated</u>
Maximum Range (Nautical miles)			To Be Determined
Launch Altitude (feet)			
Minimum			To Be Determined
Maximum			To Be Determined
Maximum Low Altitude Speed (Mach Number)			To Be Determined
Terminal Accuracy (feet)			To Be Determined

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: Air Launch Assault Breaker
Budget Activity: Tactical Programs, 4

(U) RESOURCES (PROJECT LISTING) (\$ IN THOUSANDS)

Project Number	Title	FY 1980	FY 1981	FY 1982	FY 1983	Additional To Completion	Total Estimated Costs
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT							
2217	PAVE MOVER Radar/Fire Control			24,537	128,781	290,105	443,423
2727	PAVE MOVER Interfaces			10,617	84,200	168,600	263,417
2728	Assault Breaker Air Launched Missile			1,020	25,081	59,905	86,006
				12,900	19,500	61,600	94,000

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: In the European conflict NATO faces numerical superiority against both air and ground Warsaw Pact forces. Successful conduct of the ground battle requires the capability to rapidly concentrate firepower on breakthrough areas in order to breakthrough forces. Standoff air to ground antiarmor warfare and battlefield management capability is needed;

contingency conflicts, this conventional standoff capability is needed to deploy, engage in hostilities.

Moreover, in to

BASIS FOR FY 1982 RDT&E REQUEST: Complete the Air Force unique Assault Breaker End-to-End demonstrations to include (1) use of PAVE MOVER for cue vectoring penetrating direct attack tactical aircraft, and (2) air launch of Assault Breaker Air Launched Missiles against ground mobile armored targets, with PAVE MOVER target acquisition and missile guidance commands. PAVE MOVER and Assault Breaker Air Launched Missile begin Full Scale Engineering Development

Cost estimates are based on contractor inputs and independent cost estimates.

COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable *

RDT&E *

			Total	
FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Estimated Costs
			Additional To Completion	

* A FY 1981 Descriptive Summary for this Program Element was not prepared. PAVE MOVER Full Scale Development had been funded under Program Element 63616F. Air Launched Assault Breaker was initiated in FY 1981

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: Air Launch Assault Breaker
Budget Activity: Tactical Programs, 4

DETAILED BACKGROUND AND DESCRIPTION: Provides Full-Scale Engineering Development of the PAVE MOVER System beginning in FY 1982. The PAVE MOVER consists of a standoff airborne radar and fire control system for use in detection, acquisition and track; as well as three attack modes
The attack modes consist of

Further details are provide in Project 2217 and 2727 herein. This Program Element also provides Full Scale Engineering Development of the Assault Breaker Air Launched Missile (ABALM) beginning in FY 1983 following the FY 1982 Air-to-Surface missile demo in FY 1982. The ABALM is a standoff air-to-surface missile compatible with the Army Corps Support Weapon System (CSWS) for attacking mobile targets in the second echelon. The baseline missile is developed by the Army, whereas this Program Element provide sufficient funds to tailor the CSWS missile for air launch. The details for the ABALM are described in Project 2728 herein.

RELATED ACTIVITIES: There is no other system planned to provide

against second echelon anti-armor targets. This program takes advanced development products from Program Element 63747F, PAVE MOVER, and carries them through Full Scale Engineering Development. See Project 2217 and 2727 herein for further details. The Assault Breaker Air Launched Missile, developed under Project 2728 of this Program Element beginning in FY 1983, is also intended to be compatible with the Army Corps Support Weapon System's surface to surface missile. See Project 2728 herein for additional details.

(U) WORK PERFORMED BY: An Assault Breaker/PAVE MOVER System Program Office has been established at Headquarters, Electronic Systems Division, Hanscom AFB, MA. This Program Office will manage the Full Scale Engineering Development of the PAVE MOVER Radar and Fire Control System, as well as being responsible for systems/integration for all PAVE MOVER and Air Force Assault Breaker related efforts. The Assault Breaker Air Launched Missile development will be managed by the Armament Division, Eglin AFB, FL. The Air Force Test and Evaluation Center, Kirtland AFB, NM, will conduct Initial Operational Test and Evaluation of all Air Force related Full Scale Development products.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS

1. (U) FY 1980 and Prior Accomplishments: Not Applicable
2. (U) FY 1981 Program: This program transitions products from Program Element 63747F, PAVE MOVER, ongoing in FY1981 into Full Scale Development. The Assault Breaker Air Launched Missile was initiated in FY 1981 under Program Element 63616F Air Launched Assault Breaker.
3. (U) FY 1982 Planned Program: For PAVE MOVER Radar and Fire Control System, see Project 2217 herein, for PAVE MOVER Interfaces, see Project 2728 herein. Full Scale Engineering Development for the PAVE MOVER System beings in FY 1982 following the Assault Breaker End-to-End Demonstrations, taking Advanced Development products from Program Element 63747F, PAVE MOVER.
4. (U) FY 1983 Planned Program: Full Scale Engineering Development of the PAVE MOVER System continues. See Project

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: Air Launch Assault Breaker
Budget Activity: Tactical Programs, 4

5. (U) Program to Completion: Development Test and Evaluation/Initial Operational Test and Evaluation for the PAVE MOVER System and the Assault Breaker Air Launched Missile are completed. See Project 2217, 2727 and 2728 herein for details.

6. PAVE MOVER System:

EVENTS

DATE

Defense System Acquisition Review Council II
Development Test & Evaluation/Initial Operational Test & Evaluation
Air Force/Defense System Acquisition Review Council III
Initial Operating Capability

Assault Breaker Air Launched Missile:

Milestones are subject to Corps Support Weapon System. Current Army planning for Milestone III on Corps Support Weapon System is in

Project #2217

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: PAVE MOVER Radar/Fire Control

Title: Air Launch Assault Breaker

Budget Activity: Tactical Programs, 4

DETAILED BACKGROUND AND DESCRIPTION: Provides Full-Scale Engineering Development of a wide area target acquisition weapon delivery system (PAVE MOVER System), to include a standoff airborne radar sensor and fire control center for standoff detection, precise location track and attack against ground mobile second echelon targets, with emphasis on anti-armor. This Program Element carries the products of Program Element 63747F, PAVE MOVER advanced development, through engineering development. PAVE MOVER enables simultaneous engagement of multiple stationary and moving ground targets by cue vectoring penetrating tactical aircraft and using air-to-surface and surface-to-surface standoff missiles guided by PAVE MOVER to ground target arrays at

attrit massed Warsaw Pact breakthrough attempts. These standoff missiles (see project 2728 herein) carry multiple wide area antiarmor/terminally guided submunitions to achieve a multiple kill per missile. PAVE MOVER enables cue vectoring of penetrating low altitude tactical aircraft to during the weapon delivery phase. The PAVE MOVER System will provide continuous wide area detection, location and track of second echelon stopped or moving ground targets, including dispersions and areas of advancement, to enable

advanced Electronic Counter Counter Measures and Low Probability of Intercept techniques to provide protection against enemy attempts detection

The radar features wide area continuous moving target indicator

It also features two simultaneous small spot hybrid moving/fixed target indicator real time radar modes for precisely attacking moving/stopped ground targets with an overall weapon delivery accuracy of Two platforms -- the B-52 and the C-130 are among the primary aircraft currently being considered to carry the PAVE MOVER radar. The B-52 emphasizes the attributes of a flexible standoff air-to-surface missile attack capability, since the B-52 would also carry the Assault Breaker Air Launched Missile (see project 2728 herein). This B-52/PAVE MOVER and standoff missile configuration could conduct stand-off air-to-surface missile attacks to blunt a Warsaw Pact Central European armored breakthrough attempt; and the bombers could provide an

for engagement in contingency hostilities

on a C-130 platform (and other wide bodied aircraft) emphasize the attributes of PAVE MOVER for

This latter capability is vital for effectively conducting a quick-paced large scale conventional ground war, to allied force.

PAVE MOVER

RELATED ACTIVITIES: There is no other system planned to provide against second echelon armored targets. Currently, this mission is performed

The PAVE MOVER radar and Army's Stand Off Target Acquisition System (SOTAS) radar, (being developed under Program Element 63736A), are complimentary and cooperative programs. SOTAS addresses the need for an Army Division level asset to counter the near Forward Edge of the Battle Area (FEBA) enemy armor problem while the PAVE MOVER radar is intended as a theater resource for wide area battlefield management and attack to include second echelon elements but will also service Army Corps level forces. This program takes advanced development products from Program Element 63747F, PAVE MOVER, and carries them through Full Scale Engineering Development. The Army surface-to-surface standoff

Title: PAVE MOVER Radar/Fire Control

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: Air Launch Assault Breaker

Budget Activity: Tactical Programs, #4

missiles, which will be guided by PAVE MOVER during the Assault Breaker End-to-End demonstrations in FY 1981/1982, are also candidates for the Army's Corps Support Weapon System. The Assault Breaker Air Launched Missile, developed under Project 2728 of this Program Element, will also be guided by the PAVE MOVER. All PAVE MOVER interfaces will be delineated and managed under Project 2728 of this Program Element. Formal liaison is maintained between the Services through the Assault Breaker Steering Group and the Assault Breaker Executive Committee comprised of appropriate civilian executives from the Office of the Under Secretary of Defense for Research and Engineering, the Defense Advanced Research Projects Agency (DARPA), and Air Force and Army General Officers. This project supports the Assault Breaker concept.

(U) WORK PERFORMED BY: An Assault Breaker/PAVE MOVER System Program Office has been established at Headquarters, Electronic Systems Division, Hanscom AFB, MA. This Program Office will manage the Full Scale Engineering Development of the PAVE MOVER Radar and Fire Control system. The Air Force Test and Evaluation Center, Kirtland AFB, NM, will conduct Operational Test and Evaluation of the PAVE MOVER system. Due to Army's planned operational use of PAVE MOVER, it is anticipated that the Army Operational Test and Evaluation Agency will participate in the independent PAVE MOVER operational testing.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable

2. (U) FY 1981 Program: This program transitions products from Program Element 63747F, PAVE MOVER, on-going in FY1981, into Full Scale Development.

3. FY 1982 Planned Program: This project is an FY 1982 new start, taking products from advanced development under Program Element 63747F, PAVE MOVER. The Air Force unique aspects of the Assault Breaker End-to-End Demonstrations will be completed. These demonstrations consist of (1) the Direct Attack demo segment consisting of the PAVE MOVER used to acquire and track multiple ground mobile targets and simultaneously cue vector low altitude F-4 penetrating aircraft to attack ground mobile armored targets and (2) the Air-to-Surface Missile demo segment consisting of using the standoff PAVE MOVER to acquire and track ground mobile targets and guide standoff air-to-surface missiles (Assault Breaker Air Launched Missiles, see Project 2728 herein) launched from a second standoff B-52 platform against ground mobile targets. At the conclusion of the Assault Breaker Demonstrations, this project will, after which Full Scale Engineering Development of the PAVE MOVER System begins. PAVE MOVER interfaces will be managed under Project 2728 of this Program Element.

PAVE MOVER engineering development had been programmed in the FY 1981 President's Budget under as part of an earlier endeavor to

However, final studies/briefings on the possibility of

Accordingly, the out-year dollars

are now programmed in this project. Final PAVE MOVER platform decision will be

decided prior to Milestone II.

Project #2217

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, 235

Title: PAVE MOVER Radar/Fire Control

Title: Air Launch Assault Breaker

Budget Activity: Tactical Programs, #4

4. (U) FY 1983 Planned Program: Full Scale Engineering Development of the PAVE MOVER radar/fire control system continues. Threshold electronic counter-counter measure capabilities and target discrimination capabilities will be transitioned from Program Element 63747F into engineering development, with planned incremental technical thresholds demonstrated prior to key program milestones.

5. Program to Completion: Development Test and Evaluation/Initial Operational Test and Evaluation is completed to meet a late FY 1988 PAVE MOVER Initial Operational Capability consisting of five PAVE MOVER airborne radars and associated fire control centers. Long lead production funds are required

6. Milestones:

Event

Date

Defense System Acquisition Review Council II
Development Test & Evaluation/Initial Operational Test & Evaluation
Air Force/Defense System Acquisition Review Council III
Initial Operating Capability

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
			10,617	84,200	168,600	263,417
Procurement (Aircraft)					261,000	261,000

8. Comparison with FY 1981 Budget Data: The FY 1981 Descriptive Summary for this PAVE MOVER Radar/Fire Control project was not included in this Program Element. PAVE MOVER Full Scale Engineering Development

818

818

745

Project #2727

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: PAVE MOVER Interfaces

Title: Air Launch Assault Breaker

Budget Activity: Tactical Programs, #4

(U) **DETAILED BACKGROUND AND DESCRIPTION:** Provides Full Scale Engineering Development of interfaces between the radar platform with both the standoff air and ground launched missiles (see Project 2728, this Program Element and Army Corps Support Weapon System). This includes PAVE MOVER direct communication to the respective weapon via detection/demodulation on board the missile of information encoded on the radar beam as well as development of low power/low probability of intercept secure waveform transponders to enable the radar to track the supersonic missiles. This also provides development of transponder interfaces for Direct Attack penetrating aircraft to enable their operation with PAVE MOVER. It is also envisioned that the operational PAVE MOVER system could require both a self contained airborne fire control subsystem embedded on the PAVE MOVER radar platform as well as a remote/ground fire control subsystem. The former self-contained configuration would maximize the flexibility of PAVE MOVER to engage enemy forces worldwide on a short notice (to include weakly defended remote Central European regions) to delay, disrupt or destroy massed armor breakthrough attempts until additional Allied reinforcements arrive. The latter configuration, including a remote ground fire control subsystem containing additional weapon controllers, would enable Assault Breaker fire elements to maximize firepower against massed Warsaw Pact second echelon forces to preclude outnumbered first echelon engaged Allied ground forces from being overrun. Therefore, this project also develops the integration and interfaces required to incorporate the PAVE MOVER remote fire control center with existing and planned NATO and Rapid Deployment Forces Command and Control elements, and includes tailoring of an existing secure data link to couple the PAVE MOVER airborne radar/fire control center with a remote fire control subsystem. The PAVE MOVER Integrating Program Management Activity is also responsible for ensuring that respective avionics/ weapon system performance tradeoffs are conducted to optimize overall effectiveness of all Air Force related Assault Breaker efforts, and to minimize the weapon system cost per kill and system integrity/survivability. This system integration activity is accountable for developing, testing and deploying all PAVE MOVER related interfaces, and managing related avionics/armament design tradeoffs, particularly those developments conducted under Projects 2217, 2727 and 2728 of this Program Element. The PAVE MOVER System will operate with existing/planned US and Allied aircraft/weapons. Any new weapons/aircraft development interfaces entering inventory after the PAVE MOVER Initial Operating Capability and/or not included in the Program Integration/Interoperability Plan to be executed under this project will be developed under a separate program. The PAVE MOVER System, with interfaces, provides a new capability. There is no other system planned to provide real-time aircraft cueing and standoff weapon guidance to attack ground mobile armored targets.

RELATED ACTIVITIES: This Project provides integration and interfaces between the PAVE MOVER radar/fire control center and other external air and surface launched standoff missiles, penetrating tactical aircraft, existing and planned Command Control and Communication elements, and other complimentary sensor systems. The latter category includes, the Air Force and the Army Corps Support Weapon System. This project takes advanced development products from Program Element 63747F, PAVE MOVER, and carries them through Full Scale Engineering Development. Formal liaison with related Army elements is maintained through the Assault Breaker Steering Group and the Assault Breaker Executive Committee comprised of appropriate civilian executives from the Office of the Under Secretary of Defense for Research and Engineering, the Defense Advanced Research Projects Agency (DARPA), and Air Force and Army General Officers.

Project #2727

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: PAVE MOVER Interfaces

Title: Air Launched Assault Breaker

Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: System Integration Management on the PAVE MOVER System and all internal/external Air Force Assault Breaker related interfaces are managed by the PAVE MOVER Integration Activity. This System Integration Activity will be collocated with the Assault Breaker/PAVE MOVER System Program Office which has been established at Headquarters, Electronic Systems Division, Hanscom AFB, MA. This PAVE MOVER Integration Activity will serve as the single point integrating management office for all Air Force associated Assault Breaker efforts. In this capacity, integration/interface management authority will be delegated to this management office to insure that PAVE MOVER (1) is properly integrated with existing and planned US/Allied command, control and communication structure and (2) that avionics/armament technical design tradeoffs to optimize cost per kill and overall weapon system effectiveness which are responsive to overall program direction and using command needs, are conducted in a cost effective, timely manner.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable
2. (U) FY 1981 Program: This program transitions products from Program Element 63747F, PAVE MOVER, on-going in FY 1981 into Full Scale Development.
3. (U) FY 1982 Planned Program: This Project is an FY 1982 new start, taking products from advanced development under Program Element 63747F, PAVE MOVER. The PAVE MOVER Integration Activity will develop a PAVE MOVER Integration/Interoperability Plan which will be coordinated with related Air Force and Army activities. An interface specification for the PAVE MOVER System will be developed to form a development and system baseline for conducting system interface/integration tradeoffs. Following the Defense System Acquisition Review Council Milestone II, the PAVE MOVER Integration Activity will contract for the design, development and simulation analysis of PAVE MOVER/Assault Breaker interface hardware and software.
4. (U) FY 1983 Planned Program: The PAVE MOVER System integration and interface hardware and software development will continue under a planned evolutionary process.
5. (U) Program to Completion: Development Test and Evaluation/Initial Operational Test and Evaluation of PAVE MOVER System interfaces is completed prior to Defense System Review Council Milestone III in FY 1987. Development progress will focus on controlled risk reduction of critical PAVE MOVER interfaces against gradually increasing program technical milestone thresholds as measured against approved program performance goals.

6. Milestones:

Event

Date

Defense System Acquisition Review Council II
Development Test & Evaluation/Initial Operational Test & Evaluation
Air Force/Defense System Acquisition Review Council III
Initial Operating Capability

824

221

Project #2727

Program Element: #64616P

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235

Title: PAVE MOVER Interfaces

Title: Air Launched Assault Breaker

Budget Activity: Tactical Programs, #4

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDTS&E			1,020	25,081	59,905	86,006

8. Comparison with FY 1981 Budget Data: The FY 1981 Descriptive Summary for this PAVE MOVER Interfaces project was not included in this Program Element. PAVE MOVER Full Scale Engineering Development had been included

1521

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Project #2728

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #235 Budget Activity: Tactical Programs, #4

Title: Assault Breaker Air Launched Missile (ABALM)

Title: Air Launched Assault Breaker

DETAILED BACKGROUND AND DESCRIPTION: The baseline Assault Breaker Air Launched Missile (ABALM) is a standoff surface-to-surface weapon developed by the Army as an element of the Corps Support Weapon System (CSWS). This project provides development funds to tailor the baseline Army developed weapon for air carriage and launch from a B-52. The baseline weapon developed by Army includes airframe, inertial guidance and control section, propulsion section, payload dispenser section for submunitions, and submunitions themselves. The air-launched version of the baseline weapon is designated as the Assault Breaker Air Launched Missile. The Air Force will consider various anti-armor CSWS submunitions for employment with ABALM, as well as investigate other submunitions to include anti-personnel/anti-material, should they be more cost effective. Using PAVE MOVER to target and guide the ABALM, ABALM could provide significant new capability for conventionally

Central Europe. An operational ABALM would have particular utility and enhanced survivability by

And, the ABALM capability will add greater flexibility by

being able to

The ABALM launched from 20,000 feet altitude can achieve a range over and the missile carries at supersonic speeds an section of multiple submunitions to achieve a multiple kill per weapon. With either of the two anti-armor submunitions currently being developed under the Army segment of Assault Breaker (i.e., the Skeet and the Terminally Guided Submunition), a single ABALM weapon is projected to achieve better than target array. To achieve this performance, the ABALM is targeted by the PAVE MOVER radar/fire control system (see Project #2217). The PAVE MOVER detects and tracks the armored mobile company, and

Thereafter, the PAVE MOVER

with an overall system accuracy.

missile dispenser section dispenses its submunition payload

In an anti-armor missile configuration, a missile with a

Submunitions or

Breaker effort, are but have sufficient

Current submunitions employ

armored vehicles. submunition kill mechanisms are under consideration,

The effort under this project would focus on tailoring the forementioned missile, compatible with (and designed for) the Army Corps Support Weapon System, for air launch. This would include development of a missile carriage harness compatible with existing aircraft launchers, and wiring/fusing development to arm and air launch the missile.

(U) **RELATED ACTIVITIES:** This project takes development missile and payload products from the Army Corps Support Weapon System and tailors them for air launch. The resulting Assault Breaker Air Launched Missile is a part of the ongoing Army/Air Force Assault Breaker effort. Formal liaison is maintained between the Services through the Assault Breaker Steering Group and the Assault Breaker Executive Committee comprised of appropriate civilian executives from the Office of the Under Secretary of Defense for Research and Engineering, the Defense Advanced Research Projects Agency (DARPA), and Air Force and Army General Officers.

to guide the missile over the target array centroid

At the proper "end-game" altitude, the

dispenser would contain

Terminally Guided

Skeet submunitions, under development in the current Assault

Project #2728

Program Element: #64616F

DOD Mission Area: Close Air Support/Battlefield Interdiction #235

Title: Assault Breaker Air Launched Missile (ABALM)

Title: Air Launched Assault Breaker

Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: Overall Air Force activity related to Assault Breaker is managed by the Assault Breaker/PAVE MOVER System Program Office at Headquarters, Electronic Systems Division, Hanscom AFB, MA. Consideration is being given to establish a satellite office, to manage the Assault Breaker Air Launched Missile effort under this project at the Armament Division, Eglin AFB, FL. The Air Force Test and Evaluation Center, Kirtland AFB, NM, will conduct Initial Operational Test and Evaluation of the ABALM, in conjunction with the Army Operational Test and Evaluation Agency.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable

2. (U) FY 1981 Program: Assault Breaker Missile program was initiated in FY 81 under Program Element 63616F, Air Launched Assault Breaker.

3. (U) FY 1982 Planned Program: Six Assault Breaker Air Launched Missiles (ABALM) will be air launched from a B-52 bomber as a part of the Assault Breaker End-to-End demonstration. The PAVE MOVER radar/fire control system, on another aircraft, will be used to acquire the ABALM in flight and guide the missile over the terminal target array of ground mobile vehicles. From that point, the missile dispenser will release its payload of submunitions to commence their dispense pattern/attack. Unique aspects of the air-launched standoff missile attack will be demonstrated for use in determining the overall utility of ABALM, and critical missile development parameters. Based on the results of the foregoing Air-to-Surface missile demonstrations, this project will enter a Defense System Acquisition Review Council Milestone II, after which Full Scale Engineering Development of the ABALM begins. ABALM interfaces with PAVE MOVER will be managed under Project #2727 of this Program Element. ABALM aircraft integration and interfaces, peculiar support equipment and data will be managed under this Project.

4. (U) FY 1983 Planned Program: Full Scale Development of an air launched weapon compatible with the Corps Support Weapon System begins.

5. (U) Program to Completion: Development Test and Evaluation/Initial Operational Test and Evaluation is completed prior to Defense System Acquisition Review Council Milestone III.

6. Milestones: Milestones are subject to Corps Support Weapon System status. Current Army planning for Milestone III on Corps Support Weapon System are in

7. (U) Resources:

	FY 1980	FY 1981	FY 1982	FY 1983		Total
	Actual	Estimate	Estimate	Estimate	Additional to Completion	Estimated Costs
			12,900	19,500	61,600	94,000
RD&E						

8. (U) Comparison with FY 1981 Budget Data:

The FY81 Description Summary for Program Element 63616FAir Launched Assault Breaker requested funding of \$7.1 million in FY 1981, and \$2.97 million was appropriated to demonstrate launching a missile compatible with the Army's Corps Support Weapon System from an aircraft against armored targets.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64706F

DOD Mission Area: Air Warfare Support, #225

Title: Life Support System

Budget Activity: Tactical Programs #4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,200	9,400	11,200	18,800	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to provide centralized management and development of life support equipment and subsystems necessary to assure maximum functional capability of aircrews throughout all mission environments and to enhance safe escape, descent, survival and recovery in emergency situations. Also provides for development, test and standardization of emergency equipment and protective clothing and devices for non-flying personnel. This is the only United States Air Force Program Element devoted to engineering development of life support equipment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Funds are required for continuing and starting new efforts to develop life support equipment and protective clothing for flying and non-flying personnel. Over 30 different development tasks are included in this program. Each development task is the result of a validated requirement to either correct deficiencies in existing equipment or to develop new equipment. This program also directly supports all future weapon system developments for life support systems considerations. The tasks within the program have been coordinated with the other Services to avoid duplication of effort. The United States Air Force has Tri-Service research and development responsibility for some of the tasks. The estimates are based on detailed implementation plans prepared by field agencies in support of the validated operating command requirements.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,200	11,400	14,800		Continuing	Not Applicable

Procurement

Life support equipment is procured under many weapon system and air base support Program Elements.

(U) OTHER APPROPRIATION FUNDS: Life support equipment is procured under many weapon system and air base support Program Elements. Program Element 64706F funds are not used to satisfy production requirements. Funding for initial production of replacement items is normally provided by the Air Force Logistics Command System or Item Manager under various budget authorizations. Government Furnished Aeronautical Equipment acquisitions are funded by weapon system program elements. New items being introduced into the inventory for the first time are programmed by Air Force Systems Command and budgeted under various program elements. For example, The Advanced Concept Ejection Seat is procured with funds from A-10, F-15 and F-16 Aircraft Program Elements; the thermal/nuclear flashblindness goggles for the Strategic Air Command are procured under several Air Base Support Program Elements; the Rocket Fuel Handler's Clothing Outfit is procured with funds from both the Titan II and Space Shuttle Program Elements.

926(825)

Program Element: #64706F

DOD Mission Area: Air Warfare Support. #225

Title: Life Support System

Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Life Support System is composed of two major areas. The first includes the development or improvement of aircrew equipment such as flight clothing, oxygen equipment, helmets, anti-g pressure suits, nuclear flashblindness goggles, aircrew armor, ejection seats, restraint harnesses, automatic opening lap belts, parachutes, cartridge and propellant actuated devices, passenger egress systems, life preservers, rafts, anti-exposure suits, arctic clothing, survival kits, escape and evasion devices, survival radios and signaling devices. The other area includes the development or improvement of life support equipment for non-flying personnel and includes foot wear, eye protection, oxygen equipment, head protection, and hazard monitoring and protective devices. This system provides aircrews, passengers and non-flying personnel with equipment and protective clothing necessary to maximize both their functional contribution to assigned missions and to enhance the probability of their survival during emergency situations. The program provides for continual design, development, test, acquisition and operational support of personal equipment, mission related equipment and aircraft installed life support equipment.

(U) RELATED ACTIVITIES: There are several Program Elements which provide exploratory development that contribute to full scale engineering development of life support equipment. Among these are Program Element 62201F, Aerospace Flight Dynamics; Program Element 62202F, Aerospace Biotechnology; Program Element 63205F, Flight Vehicle Technology; Program Element 64601F, Chemical/Biological Defense Equipment, Program Element 62723A, Clothing, Equipment and Shelter Technology; Program Element 63747A, Clothing and Equipment, Soldier Support/Survivability; Program Element 64204A, Air Mobility Support Equipment; Program Element 64713A Combat Feeding, Clothing and Equipment; Program Element 62241N, Ejection Seat Bio-Dynamics; Program Element 62758N, Biomedical Technology; Program Element 63216N, Mission Oriented Clothing and Devices; Program Element 64264N, Life Support Equipment. All tasks within this program are coordinated with the other Services. A formal Tri-Service Steering Committee was established in 1980 to achieve standardization and prevent duplication of efforts.

(U) WORK PERFORMED BY: The Aeronautical Systems Division, Air Force Systems Command, located at Wright-Patterson Air Force Base, Ohio, provides program management responsibility. Close interaction is maintained with other Air Force System Command Product Divisions, Test Centers and Laboratories. Support is also provided by other Service organizations, i.e.: the Army Natick Research and Development Command, Natick, MA; Naval Ordnance Station, Indian Head, MD; Naval Air Development Center, Warminster, PA. The ten major contractors in FY 1980 were: AiResearch Manufacturing Company, Torrance, California; Douglas Aircraft Company, Long Beach, California; H. Koch & Sons, Anaheim, California; Irvin Industries Canada, Ltd, Ft. Erie, Ontario, Canada; Cubic Corporation, San Diego, California; Bendix Corporation, Davenport, Iowa; Gentex, Carbondale, Penn.; Talley Industries, Phoenix, Arizona; Frost Engineering, Englewood, Colorado; Motorola, Albuquerque, New Mexico and nine other contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) **FY 1980 and Prior Accomplishments:** Prior accomplishments include the development of numerous personal equipment, escape and descent, and survival and recovery equipment items now used by aircrews. Some of these items include oxygen masks and regulators, life rafts and inflation systems arctic clothing and survival kits, fire retardant flight clothing, improved aircrew helmets, survival radios and beacons, parachutes, the Advanced Concept Ejection Seat for A-10, F-15 and F-16 aircraft, Open Loop Oxygen Generating Systems for fighter and bomber aircraft and thermal flashblindness devices for the Strategic Air Command.

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Program Element: #64706F

DOD Mission Area: Air Warfare Support, #225

Title: Life Support System

Budget Activity: Tactical Programs #4

2. (U) FY 1981 Program: Continue with development of on-going tasks. Included are: Tri-Service Survival Avionics System for Search and Rescue Service; non-helmeted thermal flashblindness devices for the Tactical Air Command, Military Airlift Command and Strategic Air Command; joint United States Air Force/Canada Automatic Inflation Modulation Parachute; Joint United States Air Force/United States Navy Open Loop Oxygen Generating System for two-man fighter aircraft; lightweight helmet for the Tactical Air Command; high performance anti-g systems (valves and suits) for high acceleration aircraft; Rocket Fuel Handler's Clothing Outfit for Titan II personnel; active arm and leg restraint systems for high speed ejection; advanced aircrew armor for the Military Airlift Command; pararescue radios and other smaller life support efforts. New starts in FY 1981 will include: Vacuum packed sleeping bags, safety toed arctic boots and a one-piece arctic fire retardant flying coverall for the Alaskan Air Command; escape and evasion viewing devices, and smoke masks for ground alert personnel for the Strategic Air Command.

3. (U) FY 1982 Planned Program: Continue with development of the FY 1981 new starts and complete the development of the Survival Avionics System, Open Loop Oxygen Generating System and six other efforts. Proposed new starts will include: advanced escape system propulsion systems; single point divestment system for emergency ground egress; wind blast protective devices for high speed ejection; high performance ballistically powered restraint system and advanced aerodynamic decelerators for open ejection seats. Several programs were canceled and/or program schedules revised to account for the difference from the FY 1981 estimate.

4. (U) FY 1983 Planned Program: Continue with development efforts begun in previous years. Initiate the following new starts: integrated aircrew ensemble for survival in all global environments; design and test subsystems and components for the next generation open ejection seat; design and test advanced aircraft canopy removal systems.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64707F

DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Engineering Development)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands) 1/

<u>Title</u>	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
TOTAL FOR PROGRAM ELEMENT	1100*	3801	3900	5600	Continuing	Not Applicable

1/ The numbers contained within this Descriptive Summary are correct. However, they are at variance with the R-1 document due to late administrative action.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The increasing emphasis on Air Force operations during night and bad weather periods makes the rapid and accurate determination of weather conditions of increasing importance. The Air Force needs to use weather as a force intensifier. This requires an upgrade in weather support equipment. Several development projects are required to make this upgrade possible. These include: development of equipment to process, display, and disseminate weather data and forecasts in fixed-base and tactical weather stations; development of a Doppler weather radar; and testing of tactical decision aids which assess weather effects on precision guided munitions.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for: continued full scale development of the Automated Weather Distribution System which will upgrade fixed-base and tactical weather stations; continued Air Force contribution to the Joint Department of Defense, Commerce, and Transportation development of a Doppler weather radar (Next Generation Weather Radar); and continued testing of tactical decision aids developed to support precision guided munitions based on infrared sensors. Funding amounts are based on initial cost estimates by Air Force Systems Command for Automated Weather Distribution System and tactical decision aids and initial cost estimates by the joint agency system program office for Next Generation Weather Radar.

(U) COMPARISON WITH FY 1981 BUDGET DATA:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	1100*	5800	5300		Continuing	Not Applicable

(U) OTHER APPROPRIATIONS: Not Applicable.

*This effort funded in project 2093, Weather Systems, Program Element 64708F, Other Operational Equipment, in FY 1980.

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Program Element: #64707F

DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Engineering Development)
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The efforts in this program element will fund development of equipment and techniques bringing a long overdue upgrade of Air Force Air Weather Service support. This upgraded weather support will make weather a force intensifier on the battlefield and will develop greatly improved severe storm detection and warning through joint agency efforts. The following are addressed: AUTOMATED WEATHER DISTRIBUTION SYSTEM which will automate most weather data handling tasks within each Air Weather Service weather station at major Air Force Bases, some Army installations, and Air Force tactical facilities. This system will use a minicomputer to accelerate data handling, incorporate more efficient forecast preparation techniques, and speed dissemination of precise and up-to-date weather intelligence. Once observations, forecasts, and weather warnings become available, the system will display them to the forecaster and local users. ADVANCED WEATHER RADAR will provide a greatly improved storm detection and warning capability through a Joint Department of Defense, Commerce, and Transportation development and procurement program (called Next Generation Weather Radar). A joint program office has been formed with representatives from each of the participating agencies. This radar will detect severe surface wind, hail, tornadoes, and turbulence using Doppler techniques; automate thunderstorm tracking; accelerate severe thunderstorm identification; and improve warning accuracy and timeliness through use of interactive warning-preparation techniques. BATTLEFIELD WEATHER SYSTEMS will support employment of weapons using visible, infrared, and radar sensors. The Air Weather Service does not have the capability to provide projections of weapon system performance in current or forecast target weather conditions. Tactical decision aids will provide the needed capability. This program element provides funds for testing, evaluation, and implementation of tactical decision aids with specific weapon systems.

(U) RELATED ACTIVITIES: Program Element 64707F begins in FY 1981 as an outgrowth of Project 2093, Weather Systems, PE 64708F, Other Operational Equipment. PE 63707F, Weather Systems (Advanced Development), accomplishes advanced development projects whose results support PE 64707F. Funds for procurement of systems developed in PE 64707F are included in PE 35111F, Weather Services.

(U) WORK PERFORMED BY: Program management for Automated Weather Distribution System is provided by Electronic Systems Division, Hanscom Air Force Base, MA. Development of the Advanced Weather Radar is pursued by the Joint System Program Office for Next Generation Weather Radar which is located within Department of Commerce. Battlefield Weather Support efforts are accomplished by Armament Division, Eglin Air Force Base, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable.

2. (U) FY 1981 Program: Automated Weather Distribution System development will begin with preparation of request for proposal, study of contractor versus blue suit maintenance trade-offs, preparation of contract strategy, source selection planning, and issue of draft request for proposal to industry for comment. Advanced Weather Radar (or Next Generation Weather Radar) development will consist of system definition study by both government experts and contractors;

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preparation of system definition phase request for proposal; and selection of multiple competing contractors for the system definition phase. Finally, testing of tactical decision aids supporting infrared weapons will begin with Air Force Systems Command and Air Weather Service representatives participating in weapon systems tests by the Air Force Test and Evaluation Center. Minor funding (less than \$10K) supporting cooperative efforts with Department of Commerce will continue in an effort to evaluate low cost system candidates for Wind Sounding and Improved Weather Reconnaissance systems. Two efforts were transferred from Program Element 64707F, Weather Systems, to Program Element 63707F, Weather Systems, which accounts for the change in FY 1981 funds. First, advanced development of tactical decision aids to support infrared-based precision guided munitions was transferred. This effort was initiated in FY 1980 when no 63707F Program Element was available. Second, advanced development of software associated with the Next Generation Weather Radar was transferred since this work will be accomplished by Air Force Geophysics Laboratory. Both of these efforts support Program Element 64707F, Weather Systems, related projects.

3. FY 1982 Planned Program: Automated Weather Distribution System development will continue with submission of final request for proposal to industry and initiation of source selection. Advanced Weather Radar (or Next Generation Weather Radar) development will continue with evaluation of alternative system design proposals and award multiple contracts for development and installation of prototype systems. Evaluation and testing of tactical decision aids to support infrared systems will continue. Two efforts were transferred from Program Element 64707F, Weather Systems, to Program Element 63707F, Weather Systems, which account for the change in FY 1982 funds. These include advanced development of tactical decision aids to support infrared-based precision guided munitions and advanced development of software associated with the Next Generation Weather Radar.

4. FY 1983 Planned Program: Automated Weather Distribution System development will continue with development of the prototype system which will consist of a minicomputer, associated communications equipment, and the software required for rapid and efficient forecast preparation. Advanced Weather Radar (or Next Generation Weather Radar) development will continue with development and installation of competing prototypes. Evaluation and testing of tactical decision aids to support infrared systems will be completed.

5. Program to Completion: This is a continuing program.

6. Milestones: Not Applicable.

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8320

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64708F

DOD Mission Area: Air Warfare Support, #225

Title Other Operational Equipment
Budget Activity Tactical Programs, #4

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2054	Aerospace Facilities Eng	9,900	9,800	13,500	16,300	Continuing	Not Applicable
2093	Weather Systems Development	4,341	925	2,000	1,900	Continuing	Not Applicable
2173	Avionics Support Equipment	1,074	Transferred to PE 64707F in FY 81				0
2479	Common Support Equipment	8	956	2,500	4,100	Continuing	2,608
2505	Aircraft Firefighting Equip	940	500	500	500	Continuing	Not Applicable
2536	Mobile Acft Arresting Equip	465	700	-	-	0	2,000
2621	Rapid Runway Repair	1,000	4,754	6,800	8,500	21,634	41,900
2674	Tactical Shelters	-	665	1,000	900	Continuing	Not Applicable
5973	Visually Coupled Systems	385	1,300	700	400	Continuing	Not Applicable
		1,687					

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Technological advancements and changing threat scenarios create a continuing need to improve operational forces support equipment. This program element contains a group of projects which develop, test, and evaluate a variety of support components and equipments in response to these needs. Modifications to existing systems and/or new subsystem equipments are qualified through projects in this element to satisfy operational needs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funding for 6 individual projects in FY 1982. All projects are continuations of prior year initiations in the areas of Aerospace Facilities, Common Support Equipment, Aircraft Firefighting Equipment, Rapid Runway Repair, Tactical Shelters and Visually Coupled Systems. The above estimates are based on engineering judgment and contractor inputs.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,420	9,900	10,900	19,300	Continuing	Not Applicable

(833)

Program Element: #64708F

DOD Mission Area: Air Warfare Support, #225

Title Other Operational Equipment
Budget Activity Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

Other Procurement (P. E. 27596)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
2536 Mobile Acft Arresting Equip (Quantity)			5,829 (16)	19,149 (48)		24,978 (64)

(U) DETAILED BACKGROUND AND DESCRIPTION: The projects in this program element address operational force deficiencies, the need to reduce proliferation of support equipment, and public law requirements dealing with environmental quality and protection. A brief description of these projects follows.

GROUND SUPPORT: Project 2054, Aerospace Facilities Engineering, provides research and development in four broad areas of Air Force Civil Engineering, Base Survivability, Environmental Engineering, Aircraft Operational Surfaces, and Energy Sources. Project 2479, Common Support Equipment, provides for opportunities to reduce the proliferation of non-standard support equipment and increase fuel efficiency of this equipment. Equipments developed under this project will be applicable to many different weapons systems. Project 2505, Aircraft Firefighting Equipment, provides a continuing effort to improve the Air Force's capability to fight aircraft fires. Project 2674, Tactical Shelters, makes sure the Air Force has reliable, cost effective tactical shelter systems for its operational support needs. Project 2621, Rapid Runway Repair, addresses the problems of rapidly restoring runways, or other aircraft operational surfaces, for service following an airfield attack.

AVIONICS SUPPORT: Project 5973, Visually Coupled Systems, provides for the development of helmet mounted sights and displays which will allow slewing and aiming of various sensors throughout the pilot's visual field.

(U) RELATED ACTIVITIES: Program Elements 63723F, Aerospace Facilities Technology, and 63203F, Advanced Avionics for Aircraft, provide advanced development in the Civil Engineering and Avionics Engineering areas. Program Element 27596F, Base Operations (Tactical Air Forces), provides for procurement of Mobile Aircraft Arresting Equipment. The helmet mounted sights developed under Project 5973 will provide a high accuracy off-boresight target cruising capability for fighter and attack aircraft.

(U) WORK PERFORMED BY: Program Management is provided by the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH; Electronic Systems Division, Hanscom Air Force Base, MA; and the Air Force Engineering and Services Center, Tyndall Air Force Base, FL. In-house facilities include the Wright Aeronautical Laboratories (Avionics, Materials, and Flight Dynamics), Wright-Patterson Air Force Base, OH; Rome Air Development Center, Griffiss Air Force Base, NY; and Air Force Flight Test Center, Edwards Air Force Base, CA. Contractors include Boeing, Brunswick, National Bureau of Standards, Frost Engineering, Lear Siegler, Sperry Rand, Gitchner Mobile Systems, General Telephone and Electronics, IES Texas, Kaman Avidyne and Allied Electronics Corporation.

750 834

Program Element: #64708F

DOD Mission Area: Air Warfare Support, #225

Title Other Operational Equipment

Budget Activity Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Video tape recorders have been qualified for airborne use in tactical aircraft to improve training and mission assessment. Prototype helmet mounted sights have been developed. Developed new adhesive for tactical shelters. Developed nuclear effects test program for the Ground Launched Cruise Missile shelter. Completed reliability study for shelters.
2. (U) FY 1981 Program: Six projects will continue in FY 1981. One new project, Rapid Runway Repair, had been a task within a different project previously. New bomb-crater repair techniques will be examined. Other efforts are aimed at Air Base Survivability, Tactical Shelters, Environmental Engineering, Aircraft Operational Surfaces, and Energy Sources. Project 2479 will continue the development of standardized support equipment. Project 2505 will continue the development of firefighting trainers, procedures, equipment, agents and vehicles. Project 2536, Mobile Aircraft Arresting Equipment will continue. It will make portable an existing arresting system (BAK-13). This will permit rapid use of short sections of suitable pavement for aircraft recoveries on a contingency basis. Project 5973 will conduct qualification testing of helmet mounted sight units and support equipment.
3. (U) FY 1982 Planned Program: Project 2621 will develop and test flush runway patches for various size craters. Surface roughness criteria for A-10 and F-16 aircraft will be determined. An optimum repair plan for bomb damaged pavements will continue. Specific common support equipment items will be developed along with management tools to reduce procurement of non-standard items. Development of helmet mounted sights will continue.
4. (U) FY 1983 Planned Program: Planned funding for FY 1983 is \$16.3 million. The funding increase in FY 1983 from FY 1982 is due to increased activities in the Rapid Runway Repair, Aerospace Facilities Engineering, and Common Support Equipment projects. The work on the Aircraft Firefighting Equipment and Mobile Tactical Shelters will continue at about the same level as in FY 1982. A mobile aircraft arresting system will go into production.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

Project: #2621

Program Element: #64708F

DOD Mission Area: Air Warfare Support, #225

Title: Rapid Runway Repair

Title: Other Operational Equipment

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The existence of hardened aircraft shelters at United States Air Force bases in Europe makes airfield operating surfaces lucrative targets. Rapid Runway Repair is an engineering development program with four major technical thrusts: (1) Damage Assessment and Recovery Plan, (2) Bomb-Damage Repair, (3) Surface-Roughness Criteria Determination, and (4) Alternate Surfaces.

(U) RELATED ACTIVITIES: Program Element 63723F/2104, Rapid Runway Repair, performs advanced development of techniques and equipment improving rapid runway repair capabilities.

(U) WORK PERFORMED BY: The Air Force Engineering and Services Center, Tyndall Air Force Base, FL manages the Rapid Runway Repair program. The Aeronautical Systems Division manages the HAVE BOUNCE sub-task.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PLANS:

1. (U) FY 1980 and Prior Accomplishments: New bomb crater fill and crown materials were investigated. A post-attack environment reconnaissance sensor was prototyped. HAVE BOUNCE computer simulations and validation testing for the F-4E, C-130 and C-141 were accomplished. Concepts for alternate operating surfaces were drafted. Two new crater repair techniques were demonstrated: (a) crushed limestone for large and small craters, and (b) silikal-cement for spall damage.
2. (U) FY 1981 Program: Refine prototype sensor for a damage assessment system. Initiate aircraft soil interaction tests. Conduct HAVE BOUNCE testing on the F-15; computer simulations on the F-16, A-10 and C-5.
3. (U) FY 1982 Planned Program: The prototype damage assessment system will be field tested and transitioned into a procurement program. Equipment to mix and apply rapid setting construction materials, such as polymer concrete, will be developed and evaluated. HAVE BOUNCE aircraft tests of the A-10 and F-16 will be conducted. Construction of a prototype damage-resistant test surface will start.
4. (U) FY 1983 Planned Program: Continue ongoing efforts.
5. (U) Program to Completion: The program is completed in FY 1986 when each thrust area produces planned materials, equipment and/or technical procedures to counter validated threats.
6. (U) Milestones: Not Applicable.

Project: #2621

Program Element: #64708F

DOD Mission Area: Air Warfare Support, #225

Title Rapid Runway Repair

Title Other Operational Equipment

Budget Activity Tactical Programs, #4

7. (U) RESOURCES (\$ in Thousands):

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
		4,754	6,800	8,500	17,351	41,900

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
					<u>Costs</u>
RDT&E	3,000	5,000	9,000	22,480	41,900

Estimated funding for FY 1982 decreases from \$8.0 million in the FY 1981 budget estimate to \$6.766 million in FY 1982 budget submission due to reduction of the Program Element budget.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64710F

DoD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT 6,899 14,900 13,300 19,900 Continuing Not Applicable							
1155	Electro-Optical Collection/Reconnaissance (COMPASS SEVEN)	2,784	3,500	4,900	4,900	Continuing	Not Applicable
1156	Radiation Intelligence (RINT)	630	1,000	700	1,000	Continuing	Not Applicable
2096	Interim Tactical ELINT Processor (ITEP)	1,167	1,300	1,500	500	500	7,500
2337	Advanced Reconnaissance Sensor (ADRES)		1,600	1,600	2,800	8,600	14,800
2501	Electronic Warfare Support Measures (EWSM)		1,100	1,600	4,700	12,400	19,800
2533	Electronic Warfare/Close Air Support Joint Test (EW/CAS)	1,840	4,200	500	500	200	10,500
2704	Tactical Electronic Reconnaissance Sensor (TEREC)	328	2,200	1,700	1,700	5,100	24,800
2660	AAQ-X Infrared Sensor			800	3,800	27,400	32,000
2659	EW Area Reprogramming Capability (ARC)	150					700
2749	All Weather Target Classification Sensor					25,200	25,200

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Projects in this program element support Air Force operating commands' reconnaissance requirements by providing engineering development of airborne and ground equipment used to collect, record and process imagery and electronic warfare data for operational forces.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for the development of airborne equipment for such aircraft as the RF-4C and RC-135 and includes electronic, optical, laser and infrared sensors, along with their associated data links and ground equipment, such as the Tactical Electronic Reconnaissance System. Cost estimates for conduct of these projects are based on best engineering estimates by experienced personnel in the Aeronautical Systems Division and Electronic Systems Division of Air Force Systems Command.

Program Element: #64710F

DOD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional To Completion	Total Estimated Costs	Not Applicable
RDT&E 1/	4,900	2/ 14,900	Estimate 13,700	Estimate	Continuing		
Procurement (Other) (PE 27213F)		4,700					

1/ Variances from FY 1981 submission include increases in FY 1982 for inflation.

2/ Includes \$2,330 transferred from FY 1978 by Congressional direction.

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) (PE 27213F)

33,600 1/
4,870

Procurement (Other)(PE 27213F)

6,336

77,700

11,206

1/ Includes \$25.0M initiated by Congress in FY 1981 for buy of additional 6 Tactical Electronic Reconnaissance Sensor systems.

Program Element: #64710F

DoD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Projects in this Program Element (PE) provide improvements to existing capabilities and provide new operational capabilities to collect, record and process imagery and electronic warfare support measures data for operational forces. These projects are primarily responsive to the reconnaissance and electronic warfare support requirements of the Tactical Air Forces, Strategic Air Command, and the Electronic Security Command. Airborne equipment includes electronic, optical, laser and infrared sensors and their associated data links. Ground equipment includes data processing and dissemination. While most systems developed under this PE become engineering prototypes for follow-on production, several projects develop unique intelligence gathering sensor systems to provide data required for design and development of new weapon systems.

(U) RELATED ACTIVITIES: All projects in this PE are coordinated as appropriate with the other Services and/or the National Security Agency groups involved in reconnaissance and electronic warfare activities. PE 63743F, Electro-Optical Warfare, and PE 63208F, Reconnaissance Sensors/Processing Technology, provide advanced development technology inputs for this PE. The Interim Tactical Electronic Intelligence Processor is being developed in coordination with the Army TENCAP Office. An electro-optical intelligence receiver for intelligence collection is being developed in conjunction with the Defense Intelligence Agency and the Defense Advanced Research Projects Agency. Procurement funds for aircraft modifications resulting from this program, such as the Tactical Electronic Reconnaissance System (TEREC) are provided by PE 27213F, RF-4C Squadrons. Procurement funds for ground exploitation facilities such as TERC processing, are generally provided by PE 27431F, Tactical Air Intelligence Systems Activities, and PE 27213F RF-4C Squadrons. Planned new starts in sensor development will address requirements for sensor capabilities for the Advanced Tactical Air Reconnaissance System (ATARS) under PE 63239F.

(U) WORK PERFORMED BY: Responsible Air Force agencies of the Air Force Systems Command include the Aeronautical Systems Division, Wright-Patterson AFB, OH, and the Electronic Systems Division, Hanscom AFB, MA. The major contractors are: Texas Instruments, Dallas, TX - ground processing; AMECOM Division of Litton Industries, College Park, MD - electronic reconnaissance sensor; and Vought Systems Division, Grand Prairie, TX - electro-optical systems.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Examples of accomplishments include: a scientific and technical electro-optical intelligence receiver including extended frequency coverage for the RC-135; an advanced aerial color film processor; a medium altitude camera; an improved infrared sensor for the RF-4C; an airborne digital data set for film annotation; a special purpose airborne laser sensor; a prototype electronic reconnaissance system for the RF-4C; and the interface for a slewable sensor and laser designator on the RF-4C. These capabilities are operational. The Tactical Electronic Reconnaissance Sensor system is now in production with projected deployment of the first system scheduled for November 1981.

Program Element: #64710F

DoD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Reconnaissance Equipment

Budget Activity: Tactical Programs, #4

2. FY 1981 Program:

- Project 1155 - Electro-Optical Collection/Reconnaissance: The capability to collect data on electro-optical (E-O) associated threat systems will be developed. Efforts will include deployment of a dual band (visual and infrared) sensor in a RC-135 aircraft; completion of development of an advanced sensor and the design and test of a high sensitivity, low energy, laser detection system for employment on A five year E-O investment strategy will be updated.
- (U) Project 2096 - Interim Tactical ELINT Processor (ITEP): The ITEP has been developed by the Army and Air Force as a transportable system that will receive, process, correlate and disseminate Electronic Intelligence (ELINT) data from a variety of collection resources. The Air Force has fielded the system as a test bed for development of ELINT correlation. The first system was delivered to the Army in September 1979. The Air Force unit was delivered in May 1980. User training is being provided for operations and maintenance of the facility; however, contractor support is required to maintain the best commercial practice hardware. Headquarters, Tactical Air Command has raised the ITEP performance and identified a need to upgrade the system from testbed status to operational status in FY 1982. This will require the addition of a user's terminal.
- (U) Project 2337 - Advanced Reconnaissance Sensor: Initiate engineering development of an advanced imaging system based on technology which has completed advanced development under Program Element 63208F, Reconnaissance Sensors/Processing Technology. This advanced reconnaissance sensor is in support of the Tactical Air Forces' requirement for an electro-optical system which provides a wide field-of-view coverage with high resolution in near-real time.
- Project 2501 - Electronic Warfare Support Measures (ESM): A development program will be initiated to qualify advanced ESM equipment that combines an electro-optical and radio frequency capability suitable for the next generation reconnaissance aircraft. The system will address threats in the band and accommodate the exotic signals expected in the late 1980s. System requirements and definition will be initiated in FY 1981.
- (U) Project 2533 - Electronic Warfare/Close Air Support Joint Test: Phase I of this Joint Test, the Tactical Communications Jamming (TCJ) phase, began October 1978 at Eglin AFB, FL. The first four tests of the TCJ phase will provide data on the effects of jamming on specific communication links. The last two tests of this phase have been completed and data is now in analyses. These tests consisted of Electronic Warfare (EW) versus Close Air Support related Command, Control and Communications (C³), EW versus Combined Arms C³, and a large scale EW versus tactical C³ test in conjunction with a Joint Exercise, Gallant Eagle 80. Preparations for Phase II, Air Support Operations, are underway.

Program Element: #64710F

DoD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs #4

(U) Project 2704 - Tactical Electronic Reconnaissance (TEREC) Sensor: The software necessary for integration of TERE data link receivers with processing equipment will be completed. This data link processing will be accomplished with the Imagery Interpretation segments of the Tactical Information Processing and Interpretation system. The sensor will be upgraded to accommodate the increasing capabilities and exotic signals of current and anticipated threats.

3. FY 1982 Planned Program:

Project 1155 - Electro-Optical Collection/Reconnaissance: A new development will be initiated for an electro-optical system on Data collection on will be continued.

(U) Project 2096 - Interim Tactical ELINT Processor: Software improvements will continue in response to a changing threat and collection capability. Follow-on software integration concepts for applications of the Tactical Air Forces will be developed and the system deployed for Operational Demonstration and Evaluation in field exercises.

(U) Project 2337 - Advanced Reconnaissance Sensor: Engineering development of the Advanced Reconnaissance Sensor will be continued and test planning will be initiated.

(U) Project 2501 - Electronic Warfare Support Measure: The Preliminary Design Review on the airborne components and ground processing elements of the system will be conducted.

(U) Project 2533 - Electronic Warfare/Close Air Support Joint Test (EW/CAS): Phase II, the air support operations phase will begin in the first quarter of FY 1981 and is scheduled for completion in 1982. This phase adds a new dimension to the scenario in the form of air defense (AD) simulators. Close air and attack helicopter support operations will be flown in a high-density EW/AD environment for evaluation of Command, Control and Communications and strike techniques; ground and air defense suppression coordination and procedures will also be addressed. Army ground units will be represented from company through corps level by headquarters elements to work with the Air Force and Marine CAS system.

(U) Project 2660 - AAQ-X Infrared Sensor: Initiate definition and development specifications for a small volume, low weight, steerable Forward Looking Infrared (FLIR) System for a near-real time passive sensor with a day/night capability. Systems to be based on infrared focal plane array technology and processing techniques now in development in Program Element 63208F, Reconnaissance Sensors/Processing Technology.

(U) Project 2704 - Tactical Electronic Reconnaissance (TEREC) Sensor: Integration of TERE and its associated ground processor will continue. Software for the TERE Remote Terminal will be completed.

Program Element: #64710F

DoD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Reconnaissance Equipment
Budget Activity: Tactical Programs #4

4. FY 1983 Planned Program:

Project 1155 - Electro-Optical Collection/Reconnaissance: Development of an electro-optical sensor system for a will
and data collection on
be continued.

(U) Project 2096 - Interim Tactical Elint Processor: Software improvements will continue in response to a changing threat and collection capability. Operational Demonstration and Evaluation of the software integration concepts will continue on the fielded system. Testbed system projected for update to operational status with initiation of procurement for a second system.

(U) Project 2337 - Advanced Reconnaissance Sensor: Engineering development of the Advanced Reconnaissance Sensor will be continued.

(U) Project 2501 - Electronic Warfare Support Measures: The Critical Design Review will be conducted for the airborne and ground processing elements of the system. Test planning and fabrication of test hardware will be initiated.

(U) Project 2533 - Electronic Warfare/Close Air Support Joint Test: Test results will be documented while final reports and final briefings will be prepared and presented.

(U) Project 2660 - AAQ-X Infrared Sensor: Engineering development of the AAQ-X sensor will be continued and planning for test and evaluation will be initiated.

(U) Project 2704 - Tactical Electronic Reconnaissance (TEREC) Sensor: Integration of the TEREC airborne and ground elements will be completed. Update of software to counter current threat emitters will be continued.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

(844)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Title: DoD Physical Security Equipment-Exterior (Eng Dev)
 Budget Activity: Tactical Programs, #4

Program Element: #64715F
 DoD Mission Area: Land Combat Service Support, #216

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number TOTAL FOR PROGRAM ELEMENT

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	14,600	19,900	8,000	19,400	23,900	130,100

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program supports the development of the Department of Defense Base and Installation Security System, a standardized set of components, interfaces, and methodology for creation of exterior physical security systems, by accomplishing full-scale development tasks in four functional areas: detection, command and control, imaging, and entry control. A Department of Defense need exists for a family of standardized modular equipment, integrable into system configurations to provide a level of security in consonance with the deployment mode, threat level, and sensitivity of the asset being protected.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Funds are required to complete engineering development of those system components intended for the Total Base and Installation Security System, to initiate engineering development of those system components which will complete advanced development during Fiscal Year 1981, and to continue engineering development of other items which were initiated in prior years. Primary emphasis will be placed on detection (sensor) subsystems, and imaging subsystems. Cost estimate based on inputs from various government agencies performing these development efforts.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	18,200	29,800	23,100		53,000	156,200
	29,594	17,562	58,481		Continuing	Not Applicable
	11,780	17,950	12,203	39,429	Continuing	Not Applicable

RDT&E

Procurement (Other)(27596F/27314F)

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)(27596F/27314F)

(845)

760 845

Program Element: #64715F

Title: DoD Physical Security Equipment-Exterior (Eng Dev)

DoD Mission Area: Land Combat Service Support, #216

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This program responds to Secretary of Defense direction contained in Department of Defense Directive 3224.3, 1 Dec 1976, which designates the Air Force as executive agency for the development of standardized exterior physical security equipment and systems for the protection of bases and installations. This program will provide pre-production equipment and subsystems, and through test and evaluation, production specifications for the Base and Installation Security System equipment for the four Services. The engineering development tasks consist of optimization of the overall system configuration through conduct of component, subsystem, and system testing, and preparation of production specifications. Under the Initial Base and Installation Security System efforts, production specifications were finalized for equipment which provides medium level security for small permanent locations and a partial system capability for selected resources deployed in a semipermanent mode. The Total Base and Installation Security System objectives are to provide a capability for high level security, against all threat levels, for resources in the three deployment modes: permanent, semipermanent, and mobile. The system will consist of four functional areas, each comprised of various modular components, capable of being integrated in various combinations and configurations to meet all Defense user requirements on a world-wide basis. Facilities and developments of other Services, government agencies, and commercial industries will be used to the maximum to insure that duplication of effort is avoided.

(U) RELATED ACTIVITIES: Advanced development tasks including equipment prototypes, development of technology base, and development testing are accomplished under Program Element 63714F, Department of Defense Physical Security Equipment-Exterior (Advanced Development). Procurement of physical security equipment is accomplished using Other Procurement-Air Force funding under Program Element 27596F, Air Base Defense System. The Base and Installation Security System equipment will be designed for interoperability with the Army interior security system (Facility Intrusion Detection System) and the Army tactical sensor system (Remotely Monitored Battlefield Sensor System). Management oversight of the physical security equipment programs is provided by the Department of Defense Physical Security Equipment Action Group with the Chairperson residing in the Office of the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: This program is managed by the Physical Security Systems Directorate, Electronic Systems Division, Hanscom Air Force Base, MA. Department of Defense agencies performing development tasks are: Rome Air Development Center, Griffiss Air Force Base, NY; Army Mobility Equipment Research and Development Command and Army Night Vision Laboratory, Fort Belvoir, VA; Army Waterways Experimental Station, Vicksburg MS; Naval Avionics Center, Indianapolis, IN; Naval Ocean Systems Center, San Diego, CA; and the Naval Coastal Systems Center, Panama City, FL. In addition to these Defense agencies, the Department of Energy/SANDIA Laboratories, Albuquerque, NM performs engineering development tasks and the Analytical Systems Engineering Corporation assists in the system engineering support and integration task.

Program Element #64715F

DoD Mission Area: Land Combat Service Support, #216

Title: DoD Physical Security Equipment-Exterior (Eng Dev)

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: All of the items undergoing development for the Initial Base and Installation Security System capability have completed engineering development. These include a buried line sensor, perimeter fence sensor, closed aircraft shelter sensor, above ground barrier sensor, wide area sensor, boundary alarm assessment segment, and sensor data transmission and display segment.
2. (U) FY 1981 Program: The program provides for continued full-scale development of the following items: electromagnetic point sensor, permanent and mobile individual resource protection sensors, video frame storage element, and magnetic/seismic line sensor signal processor. Full-scale development has started for the ported coaxial cable line sensor which completed advanced development in Fiscal Year 1980. The decrease in Fiscal Year 1981 research and development funding level was to provide an offset for higher priority programs and an inflation reduction.
3. (U) FY 1982 Planned Program: The program provides for continuation of full-scale development of the Total Base and Installation Security System components and subsystems. These include the permanent and mobile individual resource protection sensors, ported coaxial cable line sensor, electromagnetic point sensor, and open shelter aircraft sensor. Initiation of engineering development is planned for the pyroelectric vidicon camera and infrared charge coupled device fence sensor. The decrease in Fiscal Year 1982 research and development funding level is due to the termination of two activities: the waterborne intrusion detection segment and the installation security radar. Termination was effected due to the lack of firm user requirements and the increasingly high cost of these research and development efforts. The decrease in the Fiscal Year 1982 procurement funding level is due to the delay in procurement of entry control equipment and magnetic/seismic line sensor processor.
4. (U) FY 1983 Planned Program: The program provides for continuation of full-scale development of the Total Base and Installation Security System to include the entry control segment, ported coaxial cable line sensor, infrared charge coupled device fence sensor, pyroelectric vidicon camera, and open shelter aircraft sensor. The permanent and mobile individual resource protection sensors and the ported coaxial cable line sensor are expected to complete full-scale development in Fiscal Year 1983.
5. (U) Program to Completion: This program will provide type C (production) specifications for fully competitive production of a family of modular electronic equipment, capable of being integrated in various system configurations to meet Department of Defense and Service requirements for physical security. As requirements for exterior physical security are validated, development tasks will be assigned to the Air Force by the Under Secretary of Defense for Research and Engineering to satisfy the requirement. The decrease in the total estimated research and development costs is due to the termination of two activities: the waterborne intrusion detection segment and the installation security radar. Termination was effected due to the lack of firm user requirements and the increasingly high cost of these research and development efforts.

6. (U) MILESTONES: Not Applicable

770 847 848B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64724F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Tactical C3 Countermeasures

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,000	9,800	12,300	9,800	Continuing	Not Applicable
2462	Compass Call Development	6,000	9,800	12,300	4,600	Continuing	Not Applicable
2677	C3 Countermeasures Development				5,200	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To accomplish close air support, interdiction, and counter air missions the Tactical Air Forces (TAF) require a command, control and communication (C3) countermeasure capability. The TAF currently possess

The Air National Guard has EC-130E aircraft that operate in the communication frequencies; however, the capabilities are very limited for the overall C3 countermeasures task. We must improve the TAF capability to support and protect friendly forces. A key instrument to improve the TAF capability is the ability to

the engineering development of new C3 countermeasures equipment for tactical electromagnetic combat applications.

BASIS FOR FY 1982 RDT&E REQUEST: The Air Force completed a definition in FY 1979 for an EC-130H jamming aircraft as partial fulfillment of the mission need. The definition proposes a time-phased solution. This program includes all the efforts that require engineering development. These efforts are to be added to a basic capability installed on the EC-130H aircraft. The FY 1982 request is based on Air Force Systems Command pricing models and include funds to continue the development of a jamming system that

Engineering improvements are also necessary to keep the EC-130H aircraft a viable system throughout the 1980s. The tasks addressed in the FY 1982 request will improve effectiveness in a high-density environment, make the systems more responsive to the progress of the battle, keep systems up with new technology and changing threat files, and investigate new devices to complement existing capabilities.

Program Element: #64724P

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Tactical C3 Countermeasures
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RD16E	11,000	15,700	8,200		Continuing	Not Applicable

(U) OTHER APPROPRIATIONS FUNDS: Not Applicable.

(850)

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Program Element: #64724F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Tactical C³ Countermeasures
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: In FY 1979, the Air Force defined an EC-130H jamming platform to be integrated into a Defense-wide command, control and communications (C³) jamming capability. The airborne capability will complement both present and future ground and sea based systems to provide the theater commander with a coordinated jamming capability. The EC-130H jamming platform will initially use readily available equipment and will allow us to have a near-term C³ countermeasures capability. Meanwhile, the portions of the C³ countermeasures package that need development will proceed in this program. This program provides engineering development of jammers to counter or disrupt This program makes major improvements to the initial EC-130H installed equipment to make it more powerful, faster, smarter, and able to handle more threats at one time. These updates are necessary to keep the EC-130H current throughout the 1980s. This program also investigates support equipment and data.

(U) RELATED ACTIVITIES: The efforts in this program will round out the capability of the equipment installed in the EC-130H. The initial proposal for a tactical C³ countermeasures system occurred in Program Element 64739F, Tactical Protective Systems. The Air Force production manager (Air Force Logistics Command) and development manager (Air Force Systems Command) will operate with a joint agreement for interface and configuration control to ensure that new equipment developed as part of this program can be incorporated into operational use. This program also will support independent C³ countermeasure systems for other manned aircraft as well as efforts to develop a C³ countermeasures capability for drone operations. This program will build upon technology demonstrated in PE 63718F, Electronic Warfare Technology. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics; PE 62715A, Expendable Jammers; and PE 63214N, Tactical C³ Countermeasures. This program provides engineering development for PE 27253F, COMPASS CALL, PE 28021F, Electromagnetic Combat Support, and PE 27246F, Expendable Drones.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH - management of the program to develop new systems; Air Force Avionics Laboratory, Wright-Patterson AFB, OH - technique development for C³ countermeasures; and Air Force Logistics Command, Wright-Patterson AFB, OH - management of the aircraft modification program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: In FY 1978 the Air Force proposed the time-phased modification of the C-130 aircraft to perform command, control, and communications countermeasures tasks. FY 1979 saw the completion of the EC-130H definition phase with most of the effort concentrated on the antenna system. The Air Force performed a test and evaluation program to check how well an improved receiver-analyzer can handle the electromagnetic environment and started development of a jammer to disrupt

The Air Force deferred planned efforts to improve signal acquisition and analysis as well as updates to excitors and transmitters until the baseline aircraft modification program was funded. In 1980 the Air Force continued development of the jammer, and we started development of a mission simulator to help the mission crew train and maintain proficiency.

Program Element: #64724F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Tactical C³ Countermeasures

Budget Activity: Tactical Programs, #4

2. FY 1981 Program: The Air Force will continue developing the jammer to disrupt and the mission aircrew training device. The Air Force will start engineering improvement tasks on the EC-130H and investigate options for C³ countermeasures support equipment.
3. FY 1982 Planned Program: The Air Force will continue the engineering improvement tasks on the EC-130H and will start engineering development of C³ countermeasures support equipment. The Air Force plans to complete the jammer as well as the first phase of the mission simulator.
4. FY 1983 Planned Program: The Air Force will start development of command, control, and communications and design of We will also investigate the value The Air Force will continue engineering improvements to the EC-130H and engineering development of C³ countermeasures equipment.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable

(852)

774 852

Project: 2462

Program Element: #64724F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Compass Call Development

Title: Tactical C3 Countermeasures

Budget Activity: 4, Tactical Programs

DETAILED BACKGROUND AND DESCRIPTION: In FY 1979, the Air Force defined an EC-130H jamming platform to be integrated into a Defense-wide command, control and communications (C3) jamming capability. The airborne capability will complement both present and future ground and sea based systems to provide the theater commander with a coordinated jamming capability. The EC-130H jamming platform will initially use readily available equipment and will allow us to have a near-term C3 countermeasures capability. Meanwhile, the portions of the C3 countermeasures package that need development will proceed in this project. This project provides engineering development of jammers to counter or disrupt ^{This project} makes major improvements to the initial EC-130H installed equipment to make it more powerful, faster, smarter, and able to handle more threats at one time. These updates are necessary to keep the EC-130H current throughout the 1980s. This project also investigates support equipment and data.

(U) RELATED ACTIVITIES: The efforts in this project will round out the capability of the equipment installed in the EC-130H. The initial proposal for a tactical C3 countermeasures system occurred in Program Element 64739F, Tactical Protective Systems. The Air Force production manager (Air Force Logistics Command) and development manager (Air Force Systems Command) will operate with a joint agreement for interface and configuration control to ensure that new equipment developed as part of this project can be incorporated into operational use. This project will build upon technology demonstrated in PE 63718F, Electronic Warfare Technology. Technology that satisfies similar requirements for other systems may be drawn upon, such as those in PE 62204F, Aerospace Avionics; and PE 63214N, Tactical C3 Countermeasures. This project provides engineering development for PE 27253F, COMPASS CALL and PE 28021, Electromagnetic Combat Support.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH - management of the program to develop new systems for the EC-130H; Air Force Avionics Laboratory, Wright-Patterson AFB, OH - technique development for C3 countermeasures; and Air Force Logistics Command, Wright-Patterson AFB, OH - management of the aircraft modification program.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: In FY 1978 the Air Force proposed the time-phased modification of the C-130 aircraft to perform command, control, and communications countermeasures tasks. FY 1979 saw the completion of the EC-130H definition phase with most of the effort concentrated on the antenna system. The Air Force performed a test and evaluation program to check how well an improved receiver-analyzer can handle the electromagnetic environment and started development of a jammer to disrupt

The Air Force deferred planned efforts to improve signal acquisition and analysis as well as updates to excitors and transmitters until the baseline aircraft modification program was funded. In 1980 the Air Force continued development of the jammer, and we started development of a mission simulator to help the mission crew train and maintain proficiency.

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Project: 2462

Program Element: #64724F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Compass Call Development

Title: Tactical C3 Countermeasures

Budget Activity: #4, Tactical Programs

2. FY 1981 Program: The Air Force will continue developing the jammer to disrupt and the mission aircrew training device. The Air Force will start engineering improvement tasks on the EC-130H and investigate options for ground-based C3 countermeasures support equipment. Because the appropriation is less than last year's descriptive summary budget estimate, the Air Force will descope the engineering improvement tasks.

3. FY 1982 Planned Program: The Air Force will continue the engineering improvement tasks on the EC-130H and will complete the jammer as well as the first phase of the mission simulator. The increased budget estimate over the one in last year's descriptive summary is to allow the Air Force to start engineering development of C3 countermeasures support equipment.

4. FY 1983 Planned Program: The Air Force will continue engineering improvements to the EC-130H and engineering development of C3 countermeasures equipment.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E	6,000	9,800	12,300	4,600	Continuing	Not Applicable

	<u>FY 1980</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
RDT&E	11,000	15,700	8,200		Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64725F

Title: Aircraft Identification Systems

DOD Mission Area: Tactical Command and Control, #254

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	7,826*	2,553	12,200	To Be Determined	To Be Determined	To Be Determined
2463	Mark XII Identification				To Be Determined	To Be Determined	To Be Determined
2597	Friend or Foe (IFF) Program	2,900	2,553	900	To Be Determined	To Be Determined	To Be Determined
	Noncooperative Identification Subsystems	4,926		3,900	To Be Determined	To Be Determined	To Be Determined
2598	Cooperative Identification Systems	0		400	To Be Determined	To Be Determined	To Be Determined
2778	TAC Air Identification	0		7,000	To Be Determined	To Be Determined	To Be Determined

*Reflects recent reprogramming.

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The purpose of this program element is to accomplish engineering development of systems that will provide reliable long-range identification of airborne targets in both all-weather and hostile electromagnetic countermeasures environments. This program is necessary because the numerical superiority of the projected threat demands that we be capable of engaging the enemy at long ranges with our beyond visual range weapons. The long range identification which is a prerequisite for such engagements

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funding to begin development of a miniaturized interrogator system to provide a cooperative, air-to-air identification capability for the F-16. Also includes funding to begin a demonstration of near-term indirect identification techniques which exploit existing and planned data exchange/communication systems by collecting, correlating and disseminating identification information from a variety of command and control elements to weapon system users. Costing of these efforts was based on parametric and engineering estimates performed by the Combat Identification System Program Office at Aeronautical Systems Division, Wright Patterson Air Force Base, OH as of 7 January 1981.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,300	11,000	9,900		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element #64725F

DOD Mission Area: Tactical Command and Control, #254

Title: Aircraft Identification System
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND DESCRIPTION: Current and planned weapons are lethal at extremely long ranges under varying weather conditions. Operations involving the use or defense of these high-performance weapons must be supported by positive target identification to allow our forces to limit their exposure to such enemy weapons while still taking full advantage of our own weapons' capabilities and also preventing fratricide. In view of the numerical superiority of the projected threat and the likely intensity of the air battle that is postulated for any future conflict in Central Europe, In March 1978, North Atlantic Treaty Organization (NATO) Long Term Defense Program Task Force Five on Air Defense identification capability has been documented by Tactical Air Command Statements of Need 304-79 and 305-79 and most recently in a Joint Mission Element Need Statement approved by the Secretary of Defense on 30 October 1980.

The engineering development of these subsystems as well as the capability to integrate and correlate their outputs will be accomplished under this program element. All work will be a Tri-Service coordinated effort managed under the Combat Identification System Program, with the Air Force as lead service. Cooperation with NATO will be accomplished as appropriate. The work in this program element falls into three areas. Project 2463, Mark XII Identification Friend or Foe (IFF) Program is developing modifications for Mark XII IFF equipment to improve its resistance to electronic countermeasures. Project 2597, Non-cooperative Identification Subsystems will support the transition to electronic, autonomous identification techniques to the F-15 and F-16 through various engineering and test activities. This project will also develop and demonstrate the means for integrating and correlating identification data from multiple sources (e.g., sensors onboard aircraft as well as a variety of command and control elements). This is intended to raise the overall confidence and provide better management of the identification function during the weapons employment process. Project 2598, Cooperative Identification Systems will begin in FY 1982 and support the engineering development of a miniaturized interrogator system for performing cooperative identification of airborne targets. Near-term application of the interrogator will provide an air-to-air identification capability for the F-16 while the far-term application will support transition from the aging Mark XII IFF system in use today to a replacement system in the 1990s.

(U) RELATED ACTIVITIES: Work accomplished under this program element is part of an integrated Tri-Service effort to improve United States identification capabilities worldwide. Related activities include: Program Element (PE) 63267N, NATO Future Identification System; PE 63515N, Advanced Identification Techniques; PE 63706A, IFF Developments; PE 63742F, Tactical Identification Systems; PE 64211N, AIMS/ATCRBS/Mark XII; and PE 64709A, IFF Equipment. Coordination and integration of the various activities under these program elements is accomplished through the Combat Identification System Program for which the Air Force is lead service.

(U) WORK PERFORMED BY: The overall program is managed by the Combat Identification System Program Office at the Aeronautical Systems Division, Air Force Systems Command, Wright Patterson Air Force Base, OH. The program office receives support from the Air Force Wright Aeronautical Laboratories/Avionics Laboratory, Wright Patterson Air Force Base, OH

Program Element. #64725F

DOD Mission Area: Tactical Command and Control, #254

Title: Aircraft Identification System
Budget Activity: Tactical Programs, #4

and other offices within the Aeronautical Systems Division. Support is also provided by the Electronic Systems Division, Air Force Systems Command, Hanscom Air Force Base, MA; the MITRE Corporation, Bedford, MA and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Additionally, the following contractors are engaged in work under the Mark XII IFF Program: Bendix Communications Division, Baltimore, MD; Hazeltine Corporation, Greenlawn, NY; Quest Research Corporation, McLean, VA; Teledyne Electronics, Newburg Park, CA; and ARINC Research Corporation, Annapolis, MD.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Under the Mark XII IFF Program a detailed vulnerability assessment of existing Mark XII equipment was completed, various approaches for improving the electronic countermeasures performance were investigated and approaches with potential near-term application were selected for further development. Airborne data collection and analysis was completed. Also, work to adapt the identification algorithm for use on the was initiated. Additionally, engineering analysis of existing and planned command, control and communications elements was initiated to help define methods for integrating and correlating identification information from multiple sources.
2. (U) FY 1981 Program: As part of the Mark XII IFF Program, contracts were awarded to develop modification kits to improve the electronic countermeasures performance of selected Mark XII equipment. Additionally, efforts to determine the military worth/cost benefit of modifying other Mark XII equipment were initiated. The initial version of the non-cooperative target identification algorithm was transitioned to the F-15 Program Office.
3. FY 1982 Planned Program: Cost benefit analyses and tests of proposed electronic countermeasure improvement modifications for Mark XII IFF equipment will be completed and the decision on implementing the improvements will be made. Also development of a miniaturized airborne interrogation system will begin.

The initial application of this miniaturized interrogation system is expected to provide an air-to-air identification capability for the F-16. Additionally, a near-term in-theater demonstration of indirect identification techniques will be initiated. This near-term effort will exploit existing identification, intelligence, surveillance and communications resources. The initial phase will involve the use of limited electronic support measures data to demonstrate the feasibility of using this type of data in improving the overall identification process. Further, efforts to emphasize the transition of non-cooperative identification technology (anticipate incorporation into the F-15 beginning in and the F-16 in will continue through various engineering and flight test activities. This Descriptive Summary differs from the FY 1981 Descriptive Summary in that the FY 1981 requests for \$7.5 million for Non-cooperation Identification Subsystems and \$1.0 million for the NATO interoperable, cooperative (question and answer) identification system were not provided by Congress. As a result, the outyear FY 1982 funding profile was reduced to reflect the funding cut in FY 1981 for the original program. The FY 1980 reduction reflects funds reprogrammed to Program Element 63742F to address the Congressional concerns about the need for additional program planning and NATO agreement. A new program, TAC AIR Identification, was added for FY 1982.

Program Element: #64725F

DOD Mission Area: Tactical Command and Control #254

Title: Aircraft Identification System
Budget Activity: Tactical Programs, #4

4. (U) FY 1983 Planned Program: Engineering development of a miniaturized interrogation system to provide a cooperative, air-to-air identification capability for the F-16 will continue. Efforts to support the F-15 and F-16 Program Offices in incorporating non-cooperative identification capabilities will continue. Additionally, engineering development and test of ways to integrate and correlate identification information from multiple sources onboard the F-15 and F-16 will be initiated. Also, engineering development and test of a podded radio frequency sensor to perform non-cooperative, air-to-air identification passively will be initiated. In addition, the near-term in-theater demonstration of indirect identification techniques, using multiple electronic support measures sensors, will continue.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64733F
 DOD Mission Area: Defense Suppression, #224
 Title Surface Defense Suppression
 Budget Activity Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		8,900	9,800	14,400	2,600	199,400
2147	Imaging Infrared Seeker Integration		8,000	8,400	3,500		41,300
2195	Modular Guided Weapon System		900	1,400	1,500		123,600
2225	Weapon System Integration						22,500
2226	JSOR Data Link				9,400	2,600	12,000

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program develops the GBU-15 Modular Guided Weapon System. This weapon is a 2000 lb class guided glide bomb designed to destroy high value targets (interdiction), enemy surface-to-air defenses (defense suppression), and ship targets (sea lane defense). The in-production GBU-15 with television and data link (TV/DL) is optimized for low altitude launch allowing precise delivery while providing standoff range to the delivery aircraft. This combination of low altitude delivery and standoff provides effective protection of the delivery aircraft from enemy defenses. This program provides modular improvements to GBU-15 to extend its effectiveness against key targets. Key development areas address nighttime capability, improved data link operation under the jamming environment postulated for post-1985, and support equipment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The in-production GBU-15 with television/data link guidance provides a highly effective capability for precision, stand-off destruction of highly defended key targets during daytime conditions. The FY 1982 program will complete the integration and initiate operational test of an imaging infrared seeker, based upon that for MAVERICK, to extend the GBU-15 capability into night operations. The infrared seeker will be a modular replacement for the television seeker; both will use the same data link. FY 1982 funding is required for the development of a depot technical repair center for the in-production television version of the GBU-15. In addition, the requested funding will develop support equipment and test procedures for the infrared seeker to ensure a readiness to support a FY 1983 production decision for the GBU-15 with infrared guidance. Budget estimates for project 2147 are based upon negotiated contract costs for contractor integration and test support and upon program office estimates for conduct and support of operational testing based upon considerable prior GBU-15 test experience. Estimates for projects 2195 and 2226 are based upon program office experience with related endeavors of similar scope.

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Title Surface Defense Suppression
Budget Activity Tactical Programs, #4

Program Element: # 64733P
DOD Mission Area: Defense Suppression, #224

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Estimated</u> <u>Costs</u>
RDT&E		37,200	38,600		24,200	273,800
Other Procurement (PE #28030F)		20,276	49,242		TBD	TBD
Aircraft Procurement		11,151	15,872		14,198	47,921

(U) OTHER APPROPRIATION FUNDS FY 1982:

	<u>FY 1980</u> <u>Actual</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
Other Procurement (PE #28030F)	16,100	20,724	51,250	51,310	TBD	TBD
(Quantity)	(35)	(65)	(240)	(250)	(TBD)	(TBD)
Aircraft Procurement		10,200	16,400	10,200		42,600

(860)

860

700

Program Element: # 64733F

DOD Mission Area: Defense Suppression, #224

Title Surface Defense Suppression
Budget Activity Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Tactical Air Forces require a capability to destroy key surface targets with accurately delivered munitions without exposing the delivery aircraft to enemy defenses. This program develops the GBU-15 Modular Guided Weapon System to meet that requirement; and provides improvements in modular form. The GBU-15 is a cruciform wing weapon optimized for very low level, stand-off delivery of a unitary or cluster warhead in the 2000 lb range. The in-production configuration of GBU-15 utilizes a television seeker in the weapon nose to provide extremely accurate targeting information. Via data link, an operator in a standoff, controlling aircraft can "fly" the guided warhead to a specific target alpoint providing high effectiveness against key interdiction (bridges, tunnels, power plants, etc), surface to air defense, and ship targets. To extend the capabilities of the GBU-15 into conditions of night and haze, an imaging infrared seeker highly common with the MAVERICK seeker is being integrated into GBU-15 under project 2147 of this program. The infrared seeker will be a direct modular replacement for the television seeker module; both seekers will utilize the same data link. To provide effective data link operation in the intense jamming environment postulated for the period beyond 1985, Project 2226 will prototype a Jam Resistant Data Link to augment the current anti-jam capability obtained via directional antennas and tactics. Project 2195 has developed the basic weapon system and continues to develop modular improvements to extend the effectiveness of the GBU-15, and related support equipment. In addition to the GRU-15, a planar wing variant optimized for high altitude launch, has been developed within Project 2195. Development of that version, designated the GBU-20, has been suspended due to problems encountered during testing and fiscal constraints.

(U) RELATED ACTIVITIES: Related and supporting efforts are pursued in Program Element (PE) 64742F, Precision Location Strike System (PLSS) and PE 64608F, Close Air Support Weapon System. PE 64742F develops Distance Measuring Equipment for adverse weather guidance; PE 64608F develops an imaging infrared seeker to be used on the Air Force and Navy versions of the MAVERICK and GBU-15 weapons. PE 64742F, Project 2589, Joint Service Weapon Data Link, initiated the development of a jam-resistant data link to be used on the GBU-15 and in support of PLSS.

WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command (AFSC), Andrews AFB MD, and Armament Division (AD), Eglin AFB FL. Major contractors are Rockwell International, Columbus OH; Fairchild Camera Inst., Long Island NY; and Hughes Aircraft Co, Culver City/Canoga Park CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Both the Planar Wing GBU-20 and Cruciform Wing GBU-15 Weapons incorporate prior year development efforts which began in FY 1974. These include design and wind tunnel work, design of a data link, and development of a cluster warhead known as the Cluster Bomb unit (CBU-75). Development and flight testing of the basic Cruciform Weapon was to be completed in FY 1976; however, due to the operational advantages of a weapon with data link, the flight test program was expanded to include data link testing which was completed in early FY 1978. Also, Distance Measuring Equipment (DME) equipped Cruciform and Planar Wing Weapons were flight tested. Additional testing of the GBU-15 was completed in March 1980 to satisfy Congressional concerns which arose during the FY 1979

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NO 261

Program Element: # 64733F

DOD Mission Area: Defense Suppression, #224

Title Surface Defense Suppression

Budget Activity Tactical Programs, #4

Appropriations hearing. Flight testing of the Planar Wing Weapon (GBU-20) with television and data link was conducted with the B-52D. Development of the Planar Wing GBU-20 has been suspended due to problems encountered during testing and fiscal constraints. The program was zero funded in FY 1980. It was continued through FY 1980 using FY 1979 funds. The GBU-15 (cruciform wing weapon) was recertified for production by the Department of Defense in April 80. Funding for initial USAF production of GBU-15 was provided by Congress in the FY 1980 Supplemental Appropriations Bill; the initial USAF production contract was awarded in September 80.

2. (U) FY 1981 Program: Imaging infrared seeker and GBU-15 module integration will be conducted and development flight testing initiated. Support equipment for the in-production GBU-15 with television/data link (TV/DL) will continue to be developed and updated to a production configuration.

3. (U) FY 1982 Planned Program: Operational flight testing for the GBU-15 with infrared seeker will be initiated to demonstrate the capability of this system to accurately attack high-value targets during night and haze conditions. This seeker, as a modular replacement for the in-production television seeker, will provide the GBU-15 precision, stand-off attack capability on a 24-hour basis. Development of the depot technical repair center for the in-production GBU-15 will be initiated. Support equipment and test procedures for the infrared seeker will be developed to ensure a readiness to support a FY 1983 production decision for GBU-15 with infrared guidance. In-house activities will be accomplished to ensure readiness to conduct a funded effort in FY83 for design and limited prototyping of a jam-resistant data link. Funding differences from that shown in the FY 1981 Descriptive Summary reflect the FY 1981 funding appropriated for this program element, the suspension of development of the GBU-20 Planar Wing Weapon, and the resultant restructuring of the imaging infrared seeker integration and test project.

4. (U) FY 1983 Planned Program: Testing will be completed and a production decision obtained for the GBU-15 with imaging infrared seeker. Jam Resistant Data Link design will be initiated. Development of depot technical repair center for the in-production GBU-15 will be completed. Support equipment for the infrared seeker will be updated to a production configuration.

5. (U) Program to Completion: A prototype of the Jam Resistant Data Link will be fabricated. Funding differences for the total estimated program costs from that shown in the FY81 Descriptive Summary are primarily attributable to the suspension of development of the GBU-20 Planar Wing Weapon and the descopeing of the Jam Resistant Data Link project to a prototype effort.

6. (U) Milestones:

- A. GBU-15/TV/DL Initial Production Contract Award
- B. GBU-15/TV/DL Initial Production Delivery
- C. Start GBU-15/Infrared/DL Operational Testing
- D. GBU-15/Infrared/DL Production Decision

September 1980
December 1981
February 1982
July 1983

862

917

Budget Activity: Tactical Program, #4

Program Element: 64733F, Surface Defense Suppression

Test and Evaluation Data

1. (U) Development Test and Evaluation:

(U) The Glide Bomb Unit (GBU)-15(V)/B Modular Guided Weapon System is a family of guidance and control and airfoil modules which, when combined with either the MK-84 General Purpose Bomb or the Cluster Bomb Unit (CBU)-75A/B Cluster Warhead can be configured for various attack and target conditions. The GBU-15 utilizes a Cruciform Wing airfoil optimized for low level standoff delivery. Following completion of Congressional directed testing in March 80 and recertification by the Deputy Secretary of Defense, the GBU-15(V) 1/B has been approved for production; a contract for the initial United States Air Force production with a follow-on option was awarded in September 80 to Rockwell International. This version employs a television/data link guidance to allow the standoff delivery of the MK-84 bomb against high value, heavily defended targets requiring precise hitting accuracy. Development effort is continuing to integrate and test an imaging infrared guidance based upon the Maverick seeker to provide attack capability during conditions of night and light haze. The development of an anti-jam data link is planned to meet potential severe jamming threats. A Planar Wing Weapon variant developed under this program element has been redesignated as the GBU-20(V). Due to substandard test results of that weapon and fiscal constraints, further development and test of the GBU-20 has been suspended.

(U) The development contractor for the GBU-15 is Rockwell International Corp., Columbus, OH. Program management is provided by Headquarters, Air Force Systems Command, Andrews Air Force Base, MD, and its subordinate organization, Armament Division, Eglin Air Force Base, FL. The GBU-15 testing consisted of a development test and evaluation effort, conducted by Air Force System Command, and a combined development test and evaluation/initial operational test and evaluation conducted by Tactical Air Warfare Center, Eglin Air Force Base, FL. A total of 44 GBU-15s have comprised the Development Test and Evaluation portion of the test program. Mass simulation vehicles were used to verify aircraft handling and safe jettison characteristics (six MK-84 and three CBU-75A/B on F-4 and eight MK-84 on F-111). Six weapons were preprogrammed MK-84 vehicles launched from an F-4 to verify weapon response to initial autopilot design. Seven were equipped with distance measuring equipment (two MK-84 and five CBU-75A/B). Six MK-84 weapons were launched from an F-4 using television guidance in the lock-on-before-launch profile. Eight weapons were equipped with data link guidance and MK-84 warhead; three launched from an F-4, two from a B-52, and three from an F-111. All flight tests were conducted at Eglin Air Force Base, FL with the exception of distance measuring equipment tests which were conducted at White Sands Missile Range, NM. and the F-111 integration tests conducted at China Lake, CA. Fuzing systems used were the FMU-124A/B for the MK-84 and the FMU-123/B for the CBU-75 warhead. Results of the FMU-124 reliability testing was .968 at the 90 percent confidence level (requirement is .95/90 percent). An extensive series of captive flight tests was also conducted at Eglin Air Force Base, FL to evaluate airborne data link pod coverage and evaluate Electronic Counter Measures/Electro Magnetic Interference capability of both the GBU-15 and the AN/AXQ-14 data link pod. Ground tests included radar cross section testing and testing to determine the antenna pattern coverage of the AN/AXQ-14 data link pod on the F-4, F-111, and B-52. Major changes for Initial Operational Test and Evaluation weapons

Budget Activity: Tactical Program, #4

Program Element: 64733F, Surface Defense Suppression

included improvements in the autopilot for low level launch capability. Required modifications as a result of the Development Test and Evaluation program were incorporated into the Initial Operational Test and Evaluation test hardware.

(U) Hardware reliability has been examined throughout the GBU-15 test program. The cumulative demonstration mean time between failure throughout the Phase I-Phase IV Initial Operational Test and Evaluation testing was 25.1 hours versus an established standard of 14.2 hours. The goal established for out of box reliability (initial checkout) for the development pre-production hardware used in the Phase III and IV Initial Operational Test and Evaluation was 92 percent at the 85 percent confidence level. The initial test pass rate for Phase III and IV was nine weapons checked, eight passed, for 89 percent. The use of hard tooling, circuit board redesign, full electronics "burn in" and decreased "touch labor" during manufacturing are expected to improve the out-of-box reliability of the production hardware. The out-of-box reliability specification for the production hardware is 95 percent and will be checked during the Follow-On Operational Test and Evaluation. The initial United States Air Force production contract for GBU-15 with Television guidance was awarded in September 80; initial production deliveries are scheduled to begin in December 81. With the exception of producibility changes, the Initial Operational Test and Evaluation hardware represents the form, fit, and function of the hardware being procured. Follow-on Operational Test and Evaluation using production GBU-15s is planned during April-September 82. The GBU-15 with Television guidance satisfactorily passed the environmental qualification tests as required by Military Standard 810B.

(U) The integration of the Maverick Imaging Infrared seeker into the GBU-15 will extend GBU-15 operational into conditions of night and light haze. Advanced development module testing was conducted during the period 1 August 1979-31 December 1979. This testing was designed to evaluate the functional aspects of hardware design and investigate some operational use concerns. Imaging Infrared seekers and GBU-15 weapon modules will be acquired during Fiscal Year 1981 to support Development Test and Evaluation/Initial Operational Test and Evaluation. Development Test and Evaluation is scheduled to begin in August 1981. Initial Operational Test and Evaluation is scheduled for February 1982-January 1983. The principal test site for Development Test and Evaluation/Initial Operational Test and Evaluation will be Eglin Air Force Base, FL. A Test and Evaluation Master Plan has been prepared identifying specific development, operational effectiveness, and operational suitability objectives. Specific measures of effectiveness will be developed for each objective and published in the Development Test and Evaluation and Initial Operational Test and Evaluation Test Plans.

2. (U) Operational Test and Evaluation Data: GBU-15/Cruciform Wing Weapon/Television/Data Link.

(U) The testing of this weapon was accomplished in four phases. Phases I and II were combined Development Test and Evaluation/Initial Operational Test and Evaluation conducted by the Armament Division and the Tactical Air Warfare Center, October 1975-December 1977. The Initial Operational Test and Evaluation Report was published in November 1978

Budget Activity: Tactical Program, #4

Program Element: 64733P, Surface Defense Suppression

(Tactical Air Command Project 75C-003T, GBU-15 Cruciform Wing Weapon Development Test and Evaluation/Initial Operational Test and Evaluation Phase I and II, Secret). Phase III and IV were additional Initial Operational Test and Evaluation conducted by Tactical Air Warfare Center (Phase III, May 1978-June 1979; Phase IV, October 1979-February 1980). The Phase III/IV Initial Operational Test and Evaluation Report was published in May 1980 TAC Project 75C-003T, GBU-15 Cruciform Wing Weapon Initial Operational Test and Evaluation Phase III and IV, Secret). Both reports are available through the Defense Technical Information Center, Cameron Station, Alexandria, Virginia 22314.

(U) For all four phases of the test program, the Air Force Test and Evaluation Center approved the Tactical Air Warfare Center test plans, monitored the testing, and provided independent comments on the test results to the Chief of Staff, United States Air Force.

(U) In addition to the GBU-15 Initial Operational Test and Evaluation, four weapons were launched during other programs. Three weapons were launched during the F-111F PAVE TACK Development Test and Evaluation/Initial Operational Test and Evaluation, and one weapon was launched during the Precision Guided Munitions Demonstrations for the Secretary of Defense at White Sands Missile Range, NM, December 1978.

(U) The following is a summary of test results:

A total of 21 GBU-15 Initial Operational Test and Evaluation launches were conducted: 17 from the F-4E and four from the F-111F.

Of the 21 launches, 12 weapons were launched at a release altitude below 500 feet above ground level.

Budget Activity: Tactical Program, #4

Program Element: 64733F, Surface Defense Suppression

(U) A Follow-on Operational Test and Evaluation of the GBU-15 Television weapon is being planned by the Tactical Fighter Weapon Center. The test, scheduled April to September 1982, will consist of 25 weapon launches from the F-4E PAVE TACK and F-111F PAVE TACK aircraft. Emphasis during Follow-on Operational Test and Evaluation will be placed on the development of additional tactics to enhance GBU-15 employment and verification that deficiencies noted during Initial Operational Test and Evaluation have been corrected.

(U) GBU-15 Cruciform Wing Weapon/Infrared/Data Link

(U) The Air Force is currently planning for an Initial Operational Test and Evaluation of the GBU-15 Cruciform Wing Weapon in the February 1982 to January 1983 time period. Maximum use will be made of relevant prior testing on Maverick/Infrared and GBU-15 with television guidance. Captive carry testing will be emphasized where suitable to verify proper integration of the Imaging Infrared seeker with the GBU-15. By drawing upon the prior test experience and captive carry, the Air Force has reduced the number of weapon launches planned for the GBU-15/Infrared Development Test and Evaluation / Initial Operational Test and Evaluation from a total of twenty as previously planned to a total of fifteen. These weapon launches will be required to confirm the total operation of the GBU-15/Infrared weapon including its effectiveness and accuracy. This will include lock-on after launch and man-in-the-loop control using the data link (not present in Maverick testing) and suitable GBU-15 target and tactics (dissimilar from Maverick targets and tactics). Air Force Test and Evaluation Center has been designated as the Operational Test and Evaluation agency to conduct this Initial Operational Test and Evaluation which will consist of five weapon launches from the F-4E PAVE TACK aircraft and six launches from the F-111F PAVE TACK aircraft. In addition, 75 captive-carry missions, using both of the above aircraft, will be flown to generate approximately 300 passes from which data on target acquisition, acquisition ranges, and effects of weather can be obtained and evaluated.

(U) The principal test site will be Eglin Air Force Base, Florida. However, additional sites are being considered to conduct test events in an environment which more closely approximates Central Europe. Captive-carry missions will be flown off range against realistic targets. On-range targets for actual weapon launches will be selected for the degree to which they represent real world targets. Tactical Air Command aircrew and maintenance personnel will participate throughout the Initial Operational Test and Evaluation.

(U) GBU-20 (formerly designed the GBU-15 Planar Wing Weapon).

(U) Between April 1977 and August 1979, a combined Development Test and Evaluation/Initial Operational Test and Evaluation of the GBU-20 was conducted to evaluate this weapon for employment by the B-52D. Air Force Test and Evaluation Center was the Operational Test and Evaluation agency for this test. The Initial Operational Test and Evaluation published in December 1979 under the title B-52D/GBU-15 Planar Wing Weapon Initial Operational Test and Evaluation, is available from the Defense Technical Information Center.

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788 868

Budget Activity: Tactical Program, #4

Program Element: 64733F, Surface Defense Suppression

Based upon test results

867

789 867

Budget Activity: Tactical Program, #4

Program Element: 64733F, Surface Defense Suppression

3. System Characteristics:

CRUCIFORM WING WEAPON/MK-84/TELEVISION/DATA LINK TECHNICAL CHARACTERISTICS

Threshold Goal Demonstrations ¹

Launch Envelope

Maximum Mach

Maximum Altitude (feet)

Minimum Altitude (feet)

Range (Nautical Mile)

Accuracy (feet) (Circular Error Probable)

Reliability
(weapon hardware inflight)

.90³

.95

.95 4

1 Demonstration of parameter maximum was not necessarily a test objective.

2 Data not specified in technical specifications

3 Tactical Air Command goal for Initial Operational Test and Evaluation

4 Demonstrated during Development Test & Evaluation/Initial Operational Test and

Evaluation Development Test and Evaluation/Initial Operational Test and Evaluation program conducted by Tactical Warfare Center.

5 Demonstrated during Development Test and Evaluation program conducted by Air Force Systems Command

868

790 868

Project: #2147

Program Element: #64733

DOD Mission Area: Defense Suppression, #224

Title: Imaging Infrared Seeker Integration

Title: Surface Defense Suppression

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The in-production U-15 with television seeker provides an effective capability for stand-off, precision weapon delivery during conditions of daylight with moderate-to-good visibility at very low altitudes. To extend this capability into conditions of night and haze, this project provides an imaging infrared seeker for GBU-15. The feasibility of this seeker has been established in demonstrations conducted in Program Element (PE) 63601F, Conventional Weapons. Development efforts are underway to integrate this seeker into the MAVERICK missile in PE 64608F to provide a capability against mobile targets. This project develops a guidance module 80%-90% common with the Maverick seeker and integrates it into the GBU-15. Both the infrared seeker and the television seeker transmit imagery information to the operator via the same GBU-15 weapon data link module. The availability of both television and infrared seeker versions of the GBU-15 will provide the Tactical Air Forces with a critically needed day/night capability for stand-off destruction of key interdiction, defense suppression, and ship targets.

(U) RELATED ACTIVITIES: Related and supporting efforts are pursued in PE 64608F, Close Air Support Weapon System (MAVERICK); and in Project 2195, Modular Glide Weapon System, which is in this Program Element. The engineering development of the basic infrared sensor is performed in PE 64608F. The Modular Glide Weapon System project develops and supports the baseline GBU-15 weapon for this seeker integration.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command, Andrews AFB, MD and its subordinate organization, Armament Division, Eglin AFB, FL. Rockwell International Corporation, Columbus, OH is the contractor for the GBU-15 and the integration of the infrared seeker. The contractor for the development of the imaging infrared seeker is Hughes Aircraft Co., Culver City, Ca.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: This project, initiated in FY 1979, integrates the imaging infrared (IIR) guidance seeker developed in the MAVERICK program into the GBU-15. Work was initiated with the captive flight testing of an advanced development IIR seeker for evaluation. System specifications and insight into operational requirements resulted. A full scale development contract was signed with Hughes Aircraft Corp. This pursues design and development of the GBU-15 IIR module and associated interface electronics. A contract was awarded during FY 1980 to Rockwell International to procure GBU-15 flight test hardware for free flight testing with the infrared seekers. This program was zero funded in FY 1980; it was continued through FY 1980 using FY 1979 funds.
2. (U) FY 1981 PLANNED PROGRAM: IIR guidance effort will continue during FY 1981. Test hardware will be acquired, integration of the IIR guidance module with the GBU-15 conducted, and flight testing initiated. Development flight testing will involve approximately four launches.
3. (U) FY 1982 PLANNED PROGRAM: During this period, development flight testing will be completed and operational flight testing of the prototype IIR modules with the GBU-15 will be initiated. This operational flight testing, conducted by the Air Force Test and Evaluation Center, will involve approximately 11 launches and will be completed in FY 1983. Development of guidance modules and interface electronics will be completed.

Project # 2147

Program Element: #64733

DOD Mission Area: Defense Suppression, #423

Title: Imaging Infrared Seeker Integration
Title: Surface Defense Suppression
Budget Activity: Tactical Program, #4

4. (U) FY 1983 PLANNED PROGRAM: During this period the captive and free flight testing of the GBU-15 with Imaging Infrared (IIR) guidance will be completed and a production decision made.

5. (U) PROGRAM TO COMPLETION: Not Applicable

6. (U) MILESTONES:

A. Initial Integration	January 1981
B. Start Development Test and Evaluation	August 1981
C. Start Initial Operational Test and Evaluation	February 1982
D. Production Decision	July 1983

EXPLANATION OF MILESTONE CHANGES

No milestones listed in FY 1981 Descriptive Summary.

7. (U) Resources: (\$ in thousands)

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
RDTS&E		8,000	8,400	3,500		Cost
						41,300

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
RDTS&E		20,300	12,600		2,100	Cost
						56,800

The current program reflects the FY 1981 funding appropriated for this program element. The reduction in total estimated cost is due to elimination of the requirement for the IIR seeker to be integrated with the Planar Wing variant, now designated the GBU-20, and a related reduction in the planned number of weapon launches in the flight test program. Development of the GBU-20 has been suspended.

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792 870

Project: #2195

Program Element: #64733

DOD Mission Area: Defense Suppression, #224

Title: Modular Guided Weapon Systems

Title: Surface Defense Suppression

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The in-production GBU-15 with television seeker and control via data link provides a highly effective capability for stand-off destruction of key interdiction, defense suppression, and ship targets. This project develops and integrates modular improvements to the GBU-15 expanding the capability against critical targets and reducing delivery aircraft exposure to the threat environment via increased standoff and other means. In addition, support equipment, data and related supporting elements of the GBU-15 system are developed within this project.

(U) RELATED ACTIVITIES: Related and supporting efforts are pursued in (PE) 64742F, Precision Location Strike System (PLSS); and PE 64608F, Close Air Support Weapon System. PE 64742F develops Distance Measuring Equipment for adverse weather guidance; PE 64608F develops an imaging infrared seeker to be used on the Air Force and Navy versions of the MAVERICK and GBU-15 weapons.

(U) WORK PERFORMED BY: Program management is provided by Headquarters, Air Force Systems Command (AFSC), Andrews AFB, MD and Armament Division (AD), Eglin AFB, FL. Major contractors are Rockwell International, Columbus OH; Fairchild Camera Inst, Long Island NY; and Hughes Aircraft Co, Culver City/Canoga Park CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Both the GBU-15 and a Planar Wing, high-altitude variant, the GBU-20, were developed within this project and incorporate prior year development efforts which began in FY 1974. These include design and wind tunnel work, design of a data link, and development of a cluster warhead known as the Cluster Bomb Unit (CBU-75). Development and flight testing of the basic GBU-15 Cruciform Wing Weapon was to be completed in FY 1976; however, due to the operational command's preference for a weapon with data link, the flight test program was expanded to include data link testing which was completed in early FY 1979. Also, Distance Measuring Equipment (DME) equipped Cruciform and Planar Wing Weapons were flight tested. Additional testing of the GBU-15 was completed in March 1980 to satisfy Congressional concerns which arose during the FY 1979 Appropriations hearings. The GBU-15 was recertified for production by the Department of Defense in April 1980 and initial production funding was provided by Congress in the FY 1980 Supplemental Appropriations Bill. The initial USAF production contract for GBU-15 was awarded in September 1980. Development of the Planar Wing variant, GBU-20, has been suspended due to problems identified during testing and fiscal constraints.

2. (U) FY 1981 Program: Continue support equipment development and production update for the in-production GBU-15 with television/ data link (TV/DL) guidance.

3. (U) FY 1982 Planned Program: Initiate depot technical repair center development for GBU-15/TV/DL. Investigate modular enhancements to the GBU-15.

4. (U) FY 1983 Planned Program: Complete development of the depot technical repair center for GBU-15/TV/DL. Support in-house examination of modular enhancements to the GBU-15.

5. (U) Program To Completion: Support modular enhancements to the GBU-15.

871

Project: #2195

Program Element: #64733F

DOD Mission Area: Air Defense Suppression, #423

Title: Modular Guided Weapon System

Title: Surface Defense Suppression

Budget Activity: Tactical Programs, #4

6. (U) Milestones:

- A. GBU-15/TV/DL Initial Production Contract Award
- B. GBU-15/TV/DL Initial Production Delivery
- C. Complete Production Upgrade of GBU-15/TV Support Equipment
- D. Complete Depot Technical Repair Center Development

September 1980
December 1981
November 1982
August 1983

EXPLANATION OF MILESTONE CHANGES

No milestones listed in FY 1981 Descriptive Summary

7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RDT&E		900	1,400	1,500		123,600
Other Procurement	16,100	20,700	51,300	51,300	TBD	TBD
Aircraft Procurement		10,200	16,400	10,200		42,600

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RDT&E		3,300	3,900		7,200	143,900
Other Procurement (3080)		20,276	49,242		TBD	TBD
Aircraft Procurement (3010)		11,151	15,872		14,198	47,921

RDT&E funding differences from that reflected in the FY 1981 Budget Data are primarily attributable to the suspension of development of the GBU-20 Planar Wing Weapon. The current weapon procurement data reflects the procurement funding provided by the FY 1980 Supplemental Appropriations Bill and inflation adjustments to the FY 1981 budget data.

(872)

Project: #2226

Program Element: #64733F

DoD Mission Area: Defense Suppression, #224

Title: JSOR Data Link

Title: Surface Defense Suppression

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Due to the Soviet/Warsaw Pact emphasis on electronic warfare, any tactical system utilizing a data link must be capable of successful operation in a jamming environment. While the present GBU-15 in production is effective against the currently known electronic threat via a combination of antenna design and mission tactics, a data link with specific jam resistant design may be required to counter the jamming threat postulated for the period of the late 1980's. Recognizing the common necessity for protection against jamming for a number of systems utilizing data links in a tactical jamming environment, the Department of Defense has directed the development of a jam resistant joint service weapon data link. This direction is aimed at meeting the jam protection requirements for the GBU-15, the Precision Location Strike System weapons, the WALLEYE, and Army and Air Force Remotely Piloted Vehicle Systems. The Air Force is lead service for development of the joint service weapon data link. The development approach being followed utilizes a common modular architecture allowing tailoring to meet unique mission requirements by selective use of common modules and augmentation with weapon unique modules.

(U) RELATED ACTIVITIES: Army participation in the joint service program is conducted in PE 64705A, Modular Integrated Communication Navigation System. This effort is developing common video modules. Advanced development efforts for follow-on improvements to the joint service weapon data link have previously been conducted within PE 63727F, Advanced Communications Technology. FY 1981 funding for these advanced development efforts was disapproved by Congress; the efforts have been terminated.

(U) WORK PERFORMED BY: This effort is managed by the Air Force Systems Command through the Armament Division, Eglin AFB, FL. The video modules are being developed under the Modular Integrated Communications Navigation System program managed by the Army Electronics Research and Development Command, Combat Surveillance and Target Acquisition Laboratory, Fort Monmouth NJ.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In July 1977, the Precision Location Strike System (PLSS) Defense Systems Acquisition Review Council (DSARC) Milestone II directed the Air Force to incorporate the Joint Service Weapon Data Link (JSWDL) into the PLSS full scale development Program. A JSWDL systems analysis was initiated under the PLSS contract in September 1977 and completed in December 1977. A JSWDL development plan was submitted to the Air Staff in February 1978 and approved by the Air Staff and the Secretary of Defense in April 1978. In April 1978, a JSWDL specification and Statement of Work were written and put on contract by means of a change order for initial JSWDL design definition efforts leading to the submission of an Engineering Change Proposal (ECP) for the total JSWDL program. In September 1978, the ECP was received by the Air Force. During FY 1978, the Air Force incorporated JSWDL requirements into the Modular Integrated Communication Navigation System Request For Proposal, which was released to industry in August 1978. The Army awarded a contract in FY 1979 which incorporated the JSWDL requirements; the Army program will provide common video modules for JSWDL users.

Project: #2226

Program Element: #64733F

DoD Mission Area: Defense Suppression, #224

Title: JSOR Data Link

Title: Surface Defense Suppression

Budget Activity: Tactical Programs #4

2. (U) FY 1981 Program: FY 1981 activities will focus on review and coordination of related service activities. A master configuration plan will be prepared identifying the common modules for joint service support. Unique modules in support of GBU-15 jam resistant capabilities will be identified.
3. (U) FY 1982 Planned Program: In-house contractual preparation activities will be performed to ensure readiness to conduct a funded development in FY83. Acquisition plans will be prepared and system specifications finalized.
4. (U) FY 1983 Planned Program: Contractor design and development of remaining common and GBU-15 unique modules will be initiated in accordance with the master configuration plan.
5. (U) Planned Program to Completion: Complete design effort and limited prototyping of test hardware for new common and GBU-15 unique modules for the GBU-15 Jam Resistant Data Link (JRDL).

6. (U) Milestones:

A. JRDL Design Complete

B. JRDL Prototype Hardware Available

(U) EXPLANATION OF MILESTONE CHANGES

No milestones listed in FY 1981 Descriptive Summary.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Estimated</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Costs</u>
				9,400	2,600	12,000

RDTE

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Estimated</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Costs</u>
		12,600	20,600		13,400	46,600

RDTE

The current funding estimates differ from those in the FY 1981 Descriptive Summary due to descoping of the Jam Resistant Data Link project to a prototype effort.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64737F

Title: Airborne Self-Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

DOD Mission Area: Electronic Warfare and Counter-C3, #257

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,200*	12,300	55,600	21,800	17,000	110,900
2712	ASPJ Common Development	**	6,700	27,700	13,500	14,300	62,200
2714	F-111/ASPJ Development/Integration	**	-0-	-0-	-0-	To Be Determined	-0-
2715	ALQ-131/CPMS Development/Integration	**	3,100	15,100	3,600	300	22,100
2719	F/16/ASPJ Development/	**	2,500	12,800	4,700	2,400	22,400

* \$4,300 provided by Program Element 64738F

** Projects were not established

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Airborne Self-Protection Jammer (ASPJ) designated as the ALQ-165 is a Joint Air Force/Navy engineering development program for an internally mounted electronic countermeasures (ECM) system that will provide self-protection and increase the probability of aircraft survivability when various tactical aircraft (F-16, F-14, F/A-18, A-6E, and EA-6B) are confronted by modern diversified radar controlled weapon systems. Development of associated support equipment, alternate technology and aircraft integration are included. Also included is development of a Comprehensive Power Management System (CPMS) for the USAF ALQ-131 ECM Pod to be carried by those aircraft not programmed for ASPJ. Major component, subsystem and system development will continue through the full scale production decision. Engineering Development Model systems will undergo effectiveness, qualification, and reliability testing. These systems will also be used to prototype aircraft installations.

(U) BASIS FOR FY 1982 REQUEST: This request includes funds for continuing Phase II (engineering development, fabrication, assembly and testing) for the ASPJ full scale development, development and testing of associated ground support equipment to support ALQ-165 development and integration with the F-16 aircraft. Also included in this request are funds to continue development of an advanced receiver/processor (R/P), known as the CPMS, for use with the ALQ-131 ECM pod. CPMS is a derivative of the basic ASPJ R/P. CPMS will increase the capability of the ALQ-131 ECM Pod for aircraft not programmed to be equipped with ASPJ. Cost estimates are based on data from previous ECM programs, engineering estimates and contractual data from ongoing programs.

(275)

Program Element: #64737F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Airborne Self-Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E*	4,200**	12,400	32,100			

* Projects were not established for FY 1981 Descriptive Summary.

** Preliminary ASPJ effort was funded in Program Element (PE) 64739F, Tactical Protective Systems.

FY 1982: Funding in FY 1982 represents an increase of 23,500 thousand. This is attributed to CMPS & Y-16 integration.

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) PE 27133F	-0-	-0-	-0-	46,500	To Be Determined	To Be Determined
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Program Element: #64737F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Airborne Self-Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The Airborne Self-Protection Jammer (ASPJ) designated the ALQ-165 is a joint Air Force/Navy engineering development program for an internally mounted electronic countermeasures (ECM) system that will provide self-protection and increase the probability of aircraft survivability when various tactical aircraft (F-16, F-14, F/A-18, A-6E, and EA-6B) are confronted by modern diversified radar controlled weapon systems. ASPJ is necessary to counter present and projected threats

The Comprehensive Power Management System (CPMS) essentially the ASPJ receiver/processor is being developed for the ALQ-131 ECM pods. These pods will be used on aircraft not scheduled to receive ASPJ (A-7D, A-10, and F/RP-4). The ASPJ program includes development of associated support equipment, alternate technology and aircraft integration. The program will complete major component and subsystem development and continue system development through full scale production decision. Engineering Development Model systems will undergo effectiveness, qualification, and reliability testing and will be used in prototype aircraft installations for Development and Operational testing. Integrated Logistics requirements/reliability, maintenance, and training will be incorporated. The ASPJ internal ECM system is intended for installation in the F-16 aircraft.

(U) RELATED ACTIVITIES: This program is structured as a joint Navy/Air Force effort with Navy funds provided under PE 64226N, Advanced Self-Protection Systems. It is the intent of this program to attain 100% commonality of the ASPJ system design for internal application and to equally share the total group B cost of engineering between the two Services. The Air Force and Navy joint development efforts were initiated during FY 1979. Air Force funds were provided under PE 64738F, Protective Systems and PE 64739F, Tactical Protective Systems. In FY 1980 Air Force direction and funds for this effort were consolidated under PE 64737F, Airborne Self-Protection Jammer. The F-16 internal ECM (IECM) efforts are directly related to PE 27133F, F-16 Squadrons.

(U) WORK PERFORMED BY: ASPJ is managed by a joint Navy/Air Force Program Office at the Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. The Air Force unique portion of this program, integration of CPMS into the ALQ-131 and ASPJ into the F-16 is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The ASPJ/CPMS Phase I effort is being developed by two competitive contractor teams. One team is Northrop Corporation, Rolling Meadows, IL and Sanders Associates, Nashua, NH. The second team is ITT, Nutley, NJ and Westinghouse Corporation, Baltimore, MD. One of the two contractor teams will be selected during FY 1981 to proceed into Phase II (full scale engineering) development.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: In FY 1979, the ASPJ program successfully passed the Defense Systems Acquisition Review Council (DSARC) II milestone. As a result of the DSARC II decision, the Air Force was directed to fully participate with the Navy in the joint development of the ASPJ system. During FY 1979, Phase I of the ASPJ engineering development effort was initiated with the award of contracts to two competitive contractor teams. During Phase I, the program will proceed from engineering design to critical design review in FY 1981. During FY 1980 the Air Force decided to test ASPJ in the F-16 and agreed to equally share the ASPJ common development cost with the Navy. Design studies for an internal F-16 installation were initiated prior to the Air Force Program joining the ASPJ program,

Program Element: #64737F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Airborne Self-Protection Jammer

Budget Activity: Tactical Programs, #4

the Navy developed dual-mode Traveling Wave Tubes, assembled an Advanced Development Model of the ALQ-165 and conducted simulator testing of the model. The ASPJ receiver/processor design criteria has been developed for integration with the ALQ-131 Electronic Countermeasures (ECM) pod. As a result of the ASPJ Defense Systems Acquisition Review Council (DSARC) II Decision Memorandum direction, PE 64737F was established in the Air Force budget with four projects to permit better tracking of program tasks.

2. (U) FY 1981 PLANNED PROGRAM: The ASPJ Phase I engineering design will be completed with the culmination of the Critical Design Review. Phase II will be initiated when one of the two competitive contractor teams is selected to proceed into Engineering Development Model fabrication, assembly and test. The Aircraft manufacturer will complete installation design specifications for the F-16. Fabrication and assembly of the Comprehensive Power Management System (CPMS) will also be initiated for integration into the ALQ-131 ECM pod.
3. (U) FY 1982 PLANNED PROGRAM: Phase II/Engineering Development Model fabrication, assembly and test of the ASPJ/ALQ-165 will continue. Early phases of Development Test and Evaluation of the ALQ-165 and CPMS will commence. Prototype aircraft installation will begin. The CPMS will be integrated into the ALQ-131 ECM pod. Cost increase is attributed to increasing Air Force share from 37% to 50% and integrating ASPJ and CPMS into the F-16 and ALQ-131 pod respectively.
4. (U) FY 1983 PLANNED PROGRAM: Phase II of the ALQ-165 will continue and delivery of the Engineering Development Models will begin. These models will be used in the Test, Analyze and Fix Program and in development testing. Prototype aircraft installation will continue. Flight testing of CPMS will commence. Qualification testing of ASPJ and CPMS will be completed.
5. (U) PROGRAM TO COMPLETION: Complete Development and Operational Testing. DSARC III will occur during FY 1985. The completion of Initial Operational Test and Evaluation, a successful DSARC III decision and subsequent test reports will conclude this engineering development program.
6. (U) MILESTONES:

	<u>Date</u>
A. ASPJ DSARC II Decision Memorandum - Initiate Phase I full scale development	August 1979
B. Complete Phase I (Critical Design Review)	February 1981
C. Contract Award Phase II	August 1981
D. Delivery of first ASPJ Engineering Development Model	October 1982
E. Reliability/Qualification Test Complete	April 1983
F. Development/Operational Test and Evaluation Complete	July 1984
G. DSARC III	October 1984

Project: 2712

Program Element: #64737F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: ASPJ Common Development

Title: Airborne Self-Protective Jammer (ASPJ)

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND DESCRIPTION: The Airborne Self-Protection Jammer (ASPJ), ALQ-165, is required to increase Air Force and Navy tactical aircraft survivability and provide an enhanced probability of mission success. The Research, Development, Test and Evaluation effort leading to the ALQ-165 is required to develop advanced Electronic Countermeasure techniques

Fourteen ASPJ Engineering

Development Models will be used for system effectiveness evaluation, reliability testing, qualification testing and Initial Operational Test and Evaluation.

(U) RELATED ACTIVITIES: This project is structured as joint Navy/Air Force effort with Navy funds provided under PE 64226N, project W0629-TW. Development cost for this project is being shared equally between the Air Force and Navy. The F-16 internal ECM (IECM) efforts are directly related to PE 27133F, F-16 Squadrons.

(U) WORK PERFORMED BY: ASPJ Common Development is managed by a joint Navy/Air Force Program Office at the Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. Air Force support for this effort is provided by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The ASPJ Phase I effort is being developed by two competitive contractor teams. One team is Northrop Corporation, Rolling Meadows, IL and Sanders Associates, Nashua, NH. The second team is ITT, Nutley, NJ and Westinghouse Corporation, Baltimore, MD. One of the two contractor teams will be selected to proceed into Phase II (Full Scale Engineering Development). Various Naval organizations are also supporting this effort through the joint program office.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: In FY 1979, the ASPJ program successfully passed the Defense Systems Acquisition Review Council (DSARC) II milestone. As a result of the DSARC II decision, the Air Force was directed to fully participate with the Navy in the joint development of a common ASPJ system. During FY 1979, Phase I of the ASPJ engineering development was initiated with the award of contracts to two competitive contractor teams. During Phase I one the program will proceed from engineering design to critical design review in FY 1981. Aircraft installation studies were conducted. As a result of the ASPJ DSARC II Decision Memorandum direction, ASPJ efforts formerly accomplish under PE 64738F and 64739F were consolidated under PE 64737F.
2. (U) FY 1981 PLANNED PROGRAM: The design and critical item demonstration phase will be completed and Phase II, Engineering Development Model fabrication, assembly and test phase will be initiated.
3. (U) FY 1982 PLANNED PROGRAM: Phase II, Engineering Development Model fabrication, assembly and test, of the ALQ-165 development will continue. Early phases Development Test and Evaluation will commence.

Project: 2712

Program Element: #64737F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: ASPJ Common Development

Title: Airborne Self-Protection Jammer (ASPJ)

Budget Activity: Tactical Programs, #4

4. (U) FY 1983 PLANNED PROGRAM: Phase II of ALQ-165 development will continue and delivery of the Engineering Development Models will commence. These will be used in the Test, Analyze and Fix Program and in Development Testing.

5. (U) PROGRAM TO COMPLETION: Complete Development and Operational Testing. Obtain a production decision at the Defense Systems Acquisition Review Council (DSARC) III, commence production.

6. (U) MILESTONES:

- A. Phase I Full Scale Development Decision
- B. Phase II Contract Award (Fabrication and Assembly)
- C. First Engineering Development Model Delivery
- D. Reliability/Qualification Tests Complete
- E. Development/Operational Evaluation Complete
- F. DSARC III

DATE

- August 1979
- August 1980
- November 1983
- August 1983
- August 1984
- October 1984

7. (U) RESOURCES:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated</u>
RD1&E	*	6,700	27,700	13,500	14,300	62,200

* Project was not established

8. (U) COMPARISON WITH FY 1980 BUDGET DATA: (New Project)

Project: 2715

Program Element: #64737F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: ALQ-131/CPMS Development/Integration

Title: Airborne Self-Protective Jammer (ASPJ)

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project supports adapting the receiver/processor portion of the ALQ-165 (Airborne Self-Protection Jammer/ASPJ) to provide an enhanced power management capability (Comprehensive Power Management System/CPMS) for the ALQ-131 electronic countermeasures (ECM) pod.

ALQ-131 ECM pods will be used on aircraft not scheduled to be equipped with the ASPJ internal ECM system, such as the A-7D, A-10, and F/RP-4.

(U) RELATED ACTIVITIES: The initial studies for the Comprehensive Power Management System (CPMS) were accomplished under Program Element (PE) 64739F. Modification of the ALQ-131 ECM pod to include new techniques that will take full advantage of the CPMS capability will be accomplished under PE 64739F.

(U) WORK PERFORMED BY: Development of the CPMS is managed by the joint Navy/Air Force Airborne Self-Protective Jammer (ASPJ) program office at Naval Air Systems Command, Washington, D.C. Integration of CPMS into the ALQ-131 pod is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The CPMS effort is being developed by two competitive ASPJ contractor teams. One team is Northrop Corporation, Rolling Meadows IL and Sanders Associates, Nashua, NH. The second team is ITT, Nutley, NJ and Westinghouse Corporation, Baltimore MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: Studies were conducted to develop a design approach for integrating a Comprehensive Power Management System (CPMS) with the ALQ-131 pod, maximize commonality with ASPJ and how to meet performance requirements. A Memorandum of Agreement was signed in October 1978 with the Navy on CPMS development.
2. (U) FY 1981 PLANNED PROGRAM: The design and critical item demonstration phase will be completed and Phase II, Engineering Development Model fabrication, assembly and testing will be initiated.
3. (U) FY 1982 PLANNED PROGRAM: Phase II, Engineering Development Model fabrication, assembly and test, of the CPMS development will continue. Early phases of Development Test and Evaluation will commence.
4. (U) FY 1983 PLANNED PROGRAM: Phase II of CPMS development will continue and delivery of Engineering Development Models will commence. These models will be used in Development Testing.
5. (U) PROGRAM TO COMPLETION: Complete Development and Operational Testing. Obtain a Defense Systems Acquisition Review Council (DSARC III) production decision, commence production.

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Project: 2715

Program Element: #64737F

DoD Mission Area: Electronic Warfare and Counter-C³, 257

Title: ALQ-131/CPMS Development/Integration
Title: Airborne Self-Protection Jammer (ASPJ)
Budget Activity: Tactical Programs, #4

6. (U) MILESTONES:

- A. Phase I Full Scale Development Decision
- B. Phase II Contract Award (Fabrication and Assembly)
- C. First Engineering Development Model Delivery
- D. Reliability/Qualification Tests Complete
- E. Development/Operational Evaluation Complete
- F. DSARC III

DATE

August 1979
July 1983
November 1983
August 1983
August 1984
October 1984

7. (U) RESOURCES:

	<u>FY 1980</u> <u>Actual</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>To Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
RDT&E	*	3,100	15,100	3,600	300	22,100

* Project not established

8. (U) COMPARISON WITH FY 1981 BUDGET DATA: New Project

82

Project: 2719

Program Element: #64737F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: ASPJ Common Development/Integration

Title: Airborne Self-Protection Jammer (ASPJ)

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports the integration of the Airborne Self-Protection Jammer (ASPJ) (ALQ-165) in the F-16 aircraft. The ALQ-165 is a joint Navy/Air Force program to develop an internal electronic countermeasures capability for self-protection of tactical aircraft (F-16, F-14, F-18, A-6E and EA-6B) to enhance mission success and aircraft survivability when confronted by modern, diversified, radar controlled weapon systems.

(U) RELATED ACTIVITIES: Navy efforts for integrating ASPJ into Navy aircraft (F-14, F-18, A-6E and EA-6B) are funded under Program Element 64226N project W-1482.

(U) WORK PERFORMED BY: The ASPJ Program is managed by a joint Navy/Air Force Program Office at Naval Air Systems Command, Washington, D.C. The Navy is the lead Service. The F-16 integration portion of this program is managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. General Dynamics, Fort Worth, TX is the aircraft contractor.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: Preliminary aircraft installation studies have been completed. Associate Contractor Agreements have been let to the prime aircraft manufacturer (General Dynamics) for preliminary installation investigations.

2. (U) FY 1981 PROGRAM: Aircraft manufacturer complete installation design specification for the F-16. Conduct aircraft radar cross section and antenna pattern measurements.

3. (U) FY 1982 PLANNED PROGRAM: Commence prototype installation and check out in the F-16.

4. (U) FY 1983 PLANNED PROGRAM: Complete prototype installation in the F-16. Commence development testing.

5. (U) PROGRAM TO COMPLETION: Complete operational testing in the F-16. Obtain production decision for the Airborne Self-Protection Jammer and commence production line installations in F-16 aircraft.

6. (U) MILESTONES:

DATE

A. Associate Contractor Agreements

B. Complete Design Specification

C. Commence Prototype Installation, F-16

D. Complete Prototype Installation, F-16

March 1980

August 1981

November 1981

April 1983

Project: 2719
 Program Element: #64737F
 DOD Mission Area: Electronic Warfare and Counter-C3, #257
 Title: ASPJ Common Development/Integration
 Title: Airborne Self-Protection Jammer (ASPJ)
 Budget Activity: Tactical Programs, #4

7. (U) RESOURCES:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	*	2,500	12,800	4,700	2,400	22,400

* Project was not established

8. (U) COMPARISON WITH FY 1981 BUDGET DATA: New Project

(884)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64738F

Title: Protective Systems

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Budget Activity: Tactical Programs, #4

RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Cost
1627	TOTAL FOR PROGRAM ELEMENT	51,200	62,894	108,900	79,700	Continuing	Not Applicable
	Simulation, Analyses and Evaluation	4,700	6,700	5,700	6,500	Continuing	Not Applicable
2114	Antenna Test Range	1,400	1,500	1,500	2,000	Continuing	Not Applicable
2683	Radar Countermeasures	11,200	26,400	45,200	24,900	Continuing	Not Applicable
3829	Infrared and Optical Countermeasures	100	500	2,500	7,000	Continuing	Not Applicable
5615	Strategic Protective Systems	22,700	19,794	43,200	23,100	Continuing	Not Applicable
5616	F/EB-111 Protective Systems	7,200	2,300	5,900	8,700	Continuing	Not Applicable
6510	Flight Test Simulators	3,900	5,700	4,900	7,500	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for: (1) engineering development of new or improved electronic countermeasures (ECM) equipment for strategic aircraft; (2) infrared countermeasures equipment for strategic, tactical and combat support aircraft; (3) an expedited effort to develop electronic countermeasures techniques against the new generation of highly ECM resistant and very capable radar threats; (4) development of Soviet radar replicas against which electronic warfare equipments are flight tested; (5) the evaluation and analysis of electronic warfare equipment; and (6) development of an antenna test range to support both ground and airborne evaluation of new electronic warfare antennas.

BASIS FOR FY 1982 RDT&E REQUEST: The Soviets continue to develop, deploy, and provide their allies with sophisticated electronic and electro-optical surface-to-air and air-to-air weapon systems. Of particular concern is the appearance in significant numbers of both airborne and ground based threat radar systems against which current generation ECM systems have

These circumstances make it imperative that Air Force aircraft

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Protective Systems

Budget Activity: Tactical Programs, #4

carry effective electronic countermeasures (ECM) equipment which can provide protection against enemy air defenses and help ensure the successful accomplishment of assigned wartime missions without incurring unacceptable attrition. In order to ensure continued strategic bomber and cruise missile effectiveness against Soviet defensive weaponry in the 1980s and 1990s a significant investment in ECM equipment development has been made so that strategic defensive avionics programs may be accelerated. The enhancement in ECM capability deriving from these developments will ensure continued mission effectiveness of the bomber force through the 1980s and 1990s.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Cost</u>
RD&E	58,300	71,100	90,200		Continuing	Not Applicable

FY 1982: The FY 1982 amended estimate is \$18.7 million higher than estimated last year. The increases in requested funds for FY 82 are needed to: (1) develop an electronic countermeasure for the protect it against

(2) redress a projected slippage of work in the critical radar ECM development project putting this effort back on schedule; and (3) continue critical ECM system and technique development and testing for strategic aircraft.

(U) OTHER APPROPRIATIONS FUNDS: Not Applicable

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Protective Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The purpose of this program element (PE) is to: (1) develop, test and evaluate electronic countermeasures (ECM) equipment for strategic aircraft; (2) develop infrared (IR) and optical countermeasures equipment for all combat aircraft; (3) develop new ECM systems, or techniques which can be integrated into existing aircraft ECM systems, that will be effective against the new generation of highly ECM resistive radar threat weapon systems; (4) upgrade existing, or develop new, simulations/replicas of radar controlled weapon systems against which electronic warfare (EW) equipments undergo both ground and flight testing; and (5) develop/upgrade the antenna test range which supports both ground and airborne evaluation of new electronic warfare antennas. The quality, quantity and diversity of command/control and weapon systems dictate a need for improved as well as new, types of EW equipment for tactical and strategic aircraft. Laboratory and flight test simulations of defense systems are needed in order to evaluate new EW techniques, equipment and tactics. Developments are in direct response to identified operational deficiencies where existing EW equipment will not provide sufficient protection for aircraft performing assigned wartime missions. The seven numbered projects within this program element fall in two functional areas: (1) aircraft protective systems (2683 - Radar Countermeasures, 3829 - IR and Optical Countermeasures, 5615 - Strategic Protective Systems, and 5616 - F/FB-111 Protective Systems); and (2) systems analyses or testing (1627 - Simulation Analyses and Evaluation, 2114 - Antenna Test Range, and 6510 - Flight Test Simulations).

(U) RELATED ACTIVITIES: The efforts in this program build upon concepts and technology demonstrated in advanced development programs PE 63718F, Electronic Warfare Technology, and PE 63743F, Electro-Optical Warfare. They are closely coordinated with ECM engineering development projects in PE 64739F, Tactical Protective Systems.

WORK PERFORMED BY: The aircraft subsystems and laboratory simulation programs are managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The flight test simulation project is managed by the Armament Development and Test Center, Eglin AFB, FL. The antenna test range is managed by Rome Air Development Center, Griffis AFB, NY. The major contractors are: General Dynamics, Inc., Fort Worth, TX - threat simulation; Westinghouse Corp., Baltimore, MD - tail warning system for B-52 and F/FB-111; and ITT Avionics, Inc., Nutley, NJ - upgrade of ALQ-117 airborne interceptor jammer for the strategic bomber force.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Significant milestones have been production of: the B-52 jammer power management system; the B-52 pulse doppler tail warning radar system; and the ALQ-137 jammer for the FB-111. Initiations were: update of the ALQ-117 jammer for strategic bombers; development programs for replicas of systems; and continued update improvement to laboratory and flight test simulations/replicas of a wide range of radars.

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Protective Systems

Budget Activity: Tactical Programs, #4

2. FY 1981 Program: Hardware development programs for strategic bomber and tactical fighter aircraft initiated in FY 1979 and FY 1980 will continue. These include adaptation of the B-52 doppler tail warning radar system for F/FB-111 application, and ALQ-117 jammer improvement to include electronic countermeasures (ECM) for the strategic bomber force. A very significant and urgent effort has been mounted to provide ECM protection for the

against the threat radar simulators/replicas, and upgrade of the antenna test range, to support ground and flight test of electronic warfare equipment will continue. A new infrared (IR) flare (IR missile decoy device) will begin full scale engineering development. This flare (a material which is a rather than an explosive device) shows promise of being twice as effective at half the cost of existing flares. The appearance of a new generation of highly ECM resistant and very dangerous ground and airborne radar threats resulted in the FY 1980 initiation of an intensive engineering development effort aimed at providing new and effective techniques/capabilities for all Air Force combat aircraft. These efforts will continue.

3. FY 1982 Program: Major development emphasis will continue to be focused on improving B-52 ECM capability and in particular, optimizing it for the evolving B-52 cruise missile carrier mission. ALQ-117 jammer improvement will complete fabrication and begin the testing phase. The F/FB-111 doppler tail warning radar will complete the system testing required to allow a production decision. The level of effort for electronic warfare (EW) simulation facility upgrading will continue with emphasis on developing simulations of new radar systems. The major development initiative begun in FY 1980 to provide countermeasures techniques/capabilities will be reaching maturity. development is completed and both ground and flight testing of the developed ECM techniques will be accomplished. Techniques integration and testing with airborne ECM systems will begin.

4. FY 1983 Program: The ALQ-117 jammer improvement effort will complete testing and require production decision. IR flare development and flight testing will complete and require production decision. Upgrade of EW simulation and testing capabilities will continue. Development of new threat replicas and simulators will begin as both need and availability of necessary intelligence data dictate. A new engineering development initiative involving countermeasures against electro-optically directed threats will begin. A program to upgrade radar warning receivers and jammers on certain strategic and tactical aircraft with the capability to detect and jam wavelength threat weapon systems will be initiated.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

Project: #1627

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Simulation, Analyses and Evaluation

Title: Protective Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development and fabrication of laboratory simulations of radar systems and the analyses of potential candidate countermeasures systems. Definition, design and evaluation of new/improved electronic countermeasures (ECM) equipment against surveillance radars, command and control networks, and radar or optically controlled weapons requires a realistic simulation of these threats.

RELATED ACTIVITIES: This project relies on many technical intelligence sources to define and assist in the design of functional electronic duplicates (simulations) of radar systems. These laboratory simulations are used by virtually all Air Force and many Army and Navy electronic warfare development programs during definition, design and/or evaluation. The analyses capability sponsored by this project supports Program Element (PE) 63718F, Electronic Warfare Technology, PE 63743F, Electro-Optical Warfare, PE 27252F, EF-111A, PE 64724F, Tactical C³ Countermeasures and PE 64739F, Tactical Protective Systems. These simulators are also used by Strategic and Tactical Air Commands to measure the change in effectiveness of operational ECM systems resulting from the use of new tactics or equipment settings against any specific threat radar.

(U) WORK PERFORMED BY: The laboratory simulation programs are managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The major contractors are: General Dynamics, Inc., Fort Worth, TX, - Air Force Electronic Warfare Evaluation Simulator (AFEWES); Calspan Corp., Buffalo, NY - Real Time Electromagnetic Digitally Controlled Analyzer and Processor (REDCAP) Simulator; and the Aeromedical Research Laboratory, Wright-Patterson AFB, OH - Strategic Avionics Crew Station Design Facility.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Previously established simulation facilities are: the AFEWES, at General Dynamics, Fort Worth, TX; REDCAP Simulator at Calspan Corp., Buffalo, NY; and the B-52 Electronic Warfare Officer Crew Station for human factors engineering design evaluations at Wright-Patterson AFB OH. AFEWES consists primarily of five general classes of simulations of threat radar systems: (1) surface-to-air missile, (2) anti-aircraft-artillery, (3) airborne interceptor, (4) acquisition and (5) ground control intercept/height finder radars. This facility provides the Air Force and other Department of Defense agencies the capability to perform thorough assessments of electronic warfare techniques, equipment, and subsystems, as well as systematic in-depth evaluations of ECM system capabilities and weapon system survivability analyses. It is a valuable decision tool to supplement advanced development, engineering development, flight test and related analyses efforts. The unique feature of this facility is that actual ECM equipment is evaluated at its normal operating frequencies. REDCAP was established for evaluation of jamming equipment used against early warning radars and command and control network communications. The following simulator developments/upgrades continue in work:
radar and associated missile simulation;
radar simulation;
command and communications (C³) and data link systems simulation; upgrade of existing early warning (EW) and ground control, command,

Project: #1627

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Simulation, Analyses and Evaluation
Title: Protective Systems

Budget Activity: Tactical Programs, #4

controlled intercept (GCI) radar simulations to bring them into compliance with current intelligence estimates; and the development of an Adaptable Radar Simulator which can be quickly assembled from available components and preliminary intelligence estimates to provide a rapid "first-look" at a potential system.

2. FY 1981 Planned Program: Initiation of full scale development of radar simulations will begin. Installation and test of simulations and EW/GCI upgrades will make them once again available for countermeasures equipment testing. Upgrade of existing simulations will be accomplished to bring them into compliance with existing intelligence estimates.

3. FY 1982 Planned Program: Fabrication of radar simulations will continue. Upgraded simulations will be completed and made available for countermeasures testing work. The continuing effort to upgrade the various threat radar simulations to insure their compliance with latest threat estimates will continue.

4. FY 1983 Planned Program: The FY 83 program will build upon modernization and update efforts continuing from 1981 and 1982, adding simulation capability as radar or optically controlled weapon system threat data and funds availability permit.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Cost
RDTE&E	4,700	6,700	5,700	6,500	Continuing	Not Applicable

Project: #1627

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Simulation, Analyses and Evaluation
Title: Protective Systems

Budget Activity: Tactical Programs, #4

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated</u>
						<u>Cost</u>
RDT&E	4,700	5,700	5,700		Continuing	Not Applicable

(U) FY 1982: No change since FY 81 Descriptive Summary.

Project: #2683

Program Element: #64738P

DoD Area Mission: Electronic Warfare and Counter-C³, #257

Title: Radar Countermeasures

Title: Protective Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Most recent intelligence estimates confirm that approximately target tracking techniques.

Thus the Air Force now faces the serious prospect that a very weaponry. This project is being constituted as a major development initiative to focus both resources and management attention on the urgent objective to find and integrate effective radar countermeasures into existing aircraft self-protection ECM systems.

RELATED ACTIVITIES: This new project draws heavily on concepts and technology demonstrated in advanced development Program Element (PE) 63718, Electronic Warfare Technology. As techniques or new systems emerge successfully from engineering development, they may be input directly into hardware systems or channeled into selected program elements in which further integration into specific systems may be accomplished. The Air Force single manager radar countermeasures has already established direct liason with Army and Navy electronic warfare development managers and is working to establish this program on a tri-service basis.

WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division (ASD), Wright Patterson AFB, OH. Air Force has established a special management program office, nicknamed the "HAVE EXIT" Program Office, directly under the cognizance of the ASD Commander. The HAVE EXIT Program Office has management responsibility for all Air Force radar countermeasures development efforts. Major contractors are: ITT Avionics, Nutley, NJ; Sedco Systems Incorporated, Long Island, NY; Westinghouse Corporation, Baltimore, MD; Raytheon Corporation, Santa Barbara, CA; Tracor Sciences and Systems, Austin, TX; General Electric Corporation; Utica, NY.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In this project, initiated in FY 1980, the Air Force began evaluation of preliminary systems concepts submitted by industry in response to Requests for Information. Aircraft installation/integration analyses and trade studies to determine candidate systems approaches were accomplished.

2. FY 1981 Planned Program: The Air Force has established as its first priority the attainment of measures enhancement are the radar jammer for land Specific systems targeted for counter-

At the present time threat systems. Rather, a and mission effectiveness.

Board recommendations and internally conducted Air Force studies, a number of promising countermeasures techniques have been accelerated into engineering development. The selected techniques are being fabricated as quickly as

Project: #2683

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Radar Countermeasures

Title: Protective Systems

Budget Activity: Tactical Program, #4

possible and integrated into the aforementioned ECM systems for testing against actual radars. In parallel with efforts to find immediate or near term solutions for these specific hardware items, efforts will begin which will investigate other potential alternatives such as and techniques for other specialized aircraft applications. The expedited development of an improved

is planned. This effort could provide a highly effective complementary capability for the since it capitalizes on existing on-the-shelf systems which could be reinstalled in a short period of time at modest cost. The long term goal of finding a single or generic type solution will not be abandoned, and studies, analyses and some testing will be accomplished to further this objective.

3. FY 1982 Planned Program: Completion of fabrication of

Comprehensive ground and flight testing of these upgrades will lead to the selection of those which are effective and warrant production for retrofit into these systems. Parallel efforts to design, fabricate, and test corresponding improvements for FB-111 and F-15 and all other Air Force aircraft ECM systems will continue. A continuing effort to solicit and evaluate new ideas will be maintained. upgrades will occur.

4. FY 1983 Planned Program: The integration of selected

range of aircraft ECM equipment will commence. Testing of these techniques in host systems will be accomplished. The most effective techniques as determined by flight testing will be proposed for retrofit into existing systems. countermeasures techniques into a wide

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Cost</u>
RDT&E	11,200	26,400	45,200	24,900	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	17,800	27,600	42,200	Continuing	Not Applicable
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| FY 1982: The amended FY 82 request provides additional funds for development of radar counter-
| measures techniques directly applicable to the The increased funding also prevents
| slippage in the program to develop and prove techniques for incorporation in tactical aircraft ECM pods.

Project: #5615

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Strategic Protective Systems

Title: Protective Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development of new and improved electronic countermeasures (ECM) systems for strategic aircraft. The continued improvement in the quantity, quality and diversity air defense command/control and weapon systems establishes a corresponding need to provide improved self-protection countermeasures systems for strategic aircraft. For the immediate future the B-52 will continue to be the mainstay of strategic bomber aircraft offensive capability. The B-52 in its cruise missile carrying role will face a multitude of aircraft. Efforts in this project focus both on optimizing existing B-52 ECM systems to provide necessary protection, and demonstrating in actual hardware development the system technology needed for the follow-on strategic aircraft.

(U) RELATED ACTIVITIES: The efforts in this project draw heavily on concepts and technology demonstrated in advanced development Program Element (PE) 63718F, Electronic Warfare Technology, and PE 63743F, Electro-Optical Warfare. Technology from other projects within this PE and PE 64739F, Tactical Protective Systems, are utilized to the maximum extent possible.

WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson Air Force Base (AFB), OH. The major contractors are: ITR Avionics, Nutley, NJ - for update of ALQ-117 jammer, with Sedco Systems Incorporated, Long Island, NY as major subcontractor for ALQ-117 ECM antennas.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Completed efforts in prior years which are currently being installed in the B-52 as Class V modifications include: the ALQ-122 ECM system which jams the spectrum of the ALQ-155 ECM power management system, which integrates ALT-28 jammers, covering the provide rapid, accurate and prioritized jamming response to these threats; and the ALQ-153 doppler tail warning radar (which detects approaching air-to-air missiles and
Initiated developments included: update of the ALQ-117 jammer to provide

2. FY 1981 Program: Two significant efforts, one focused on providing enhanced protection for the B-52 in its cruise missile carrier role and hardware technology for the new strategic bomber, the other on providing to permit it to carry that hardware, continue in development in this project. The electronically steerable phased array jamming antenna system mentioned in previous descriptive summaries was terminated as a result of the B-52's changing mission and compounding cost and technical problems. The ALQ-117, which provides electronic countermeasure against radars continues in full scale engineering development with heavy emphasis placed on achieving a radar threat systems. ALQ-117 upgrade design will be completed and system fabrication essentially completed by the end of FY

Project: #5615

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Strategic Protective Systems

Title: Protective Systems

Budget Activity: Tactical Programs, #4

1981. The

that threat.

Fortunately ECM technology is available which can substantially reduce if not negate

3. FY 1982 Planned Program: No new development initiatives are planned. The upgraded ALQ-117 jammer will complete system fabrication and begin an extensive program of both ground and flight testing. suite will complete fabrication, ground and flight test leading to a production decision for the FY 83 buy of

4. (U) FY 1983 Planned Program: Again, no new development initiatives are planned. The upgraded ALQ-117 will complete a rigorous program of flight and qualification (reliability/maintainability/durability) testing leading to a production decision in early FY 1983.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Cost</u>
1 RDT&E	22,700	19,794	43,200	23,100	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data</u>						
RDT&E	20,900	26,400	29,400	Continuing	Continuing	Not Applicable

FY 1982: In FY 81 this program element experienced a Congressionally mandated undistributed reduction of \$18.0 million. Although the language associated with the cut was not specific, the Air Force made the assumption that the B-52 project was the area in which Congress desired that the majority of the cut be taken. The ALQ-117 project was slowed as a result of that action. In increasing the FY 82 funding level for this project the Air Force is attempting to alleviate the schedule slippage caused by the FY 81 reduction. The Air Force feels that this effort is as important to providing the hardware technology for a new strategic aircraft as it is to providing

Equally significant is the added funding for testing which will complete in FY 82.

hardware, ground and flight

Project: #5616

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: F/FB-111 Protective Systems

Title: Protective Systems

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: To increase the survivability of F-111 aircraft performing deep interdiction and F-111 aircraft performing strategic strike missions, a combination of radar warning receiver, aft-looking missile warning receiver, internal radar jammer, and chaff/flare decoys is employed. This project provides for the development of improvements to the electronic warfare systems on the tactical F-111 and strategic FB-111 series aircraft. These improvements are necessitated by the continually improving Soviet surface-to-air and air-to-air defensive systems and the deployment of new or modified radar controlled weapons.

(U) RELATED ACTIVITIES: The efforts in this program element (PE) are based on technology demonstrated in PE 63718F, Electronic Warfare Technology, and PE 63743F, Electro-Optical Warfare. Close coordination is maintained between efforts in this project and similar efforts in other projects within this PE, and PE 64739F, Tactical Protective Systems, to maximize commonality and avoid duplication of effort.

(U) WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson AFB, OH. The major contractors are: Sanders Associates, Nashua, NH - internal jammers; Dalmo-Victor Division of Textron, Belmont, CA - radar warning receiver; and Westinghouse Corporation, Baltimore - pulse doppler tail warning systems.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: In 1977 engineering development of improvements to the F/FB-111 radar warning receiver were finished and a production modification program was begun. This update provided a software controlled radar warning system to detect and locate radar threats. Also completed in 1977 was the engineering development effort to upgrade the strategic FB-111's internal jammer complement, providing it with capability to counter
| radars and other more recently defined threats.

2. FY 1981 Program: The two major efforts continued from FY 1980 included system definition studies aimed at improving the ALQ-94 jammer carried internally in tactical F-111 aircraft, and engineering integration work to install and test the proven B-52 doppler tail warning (air-to-air missile detecting) radar on the F/FB-111 aircraft. Tactical F-111 aircraft require significant improvement to their 1960s design ALQ-94 countermeasures jammer including coverage against
have fielded since 1965. Survivability of both tactical and strategic F/FB-111 aircraft would be greatly enhanced by addition of doppler tail warning radar.

Project: #5616

Program Element: #64738F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: F/PB-111 Protective System

Title: Protective Systems

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program: Installation and flight testing of doppler tail warning radar will be accomplished in 1982.

4. FY 1983 Planned Program: Completion of doppler tail warning radar testing will be accomplished requiring a production decision. A program to upgrade both radar warning receivers and jammers with the capability to detect and counter threats exemplified by the system will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Cost</u>
RDT&E	7,200	2,300	5,900	8,700	Continuing	Not Applicable

8. Comparison with FY 1981 Budget Data:

RDT&E	7,200	3,200	4,500	Continuing	Not Applicable
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(U) FY 1982: In FY 1981 this project was below the dollar threshold which required a separate project descriptive summary; thus none was provided. The FY 1982 increase of \$1.4 million is required to accommodate a slippage in the installation and test of the ALQ-153 missile warning radar which has resulted in this work being moved from FY 81 to FY 82.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64739F

Title: Tactical Protective Systems

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2272	Active Countermeasures Systems	16,146	24,600	24,300	22,300	Continuing	Not Applicable
2273	Warning Systems	8,356	19,600	13,600	11,500	Continuing	Not Applicable
2274	Dispensers and Expendables		400	4,000	4,500	Continuing	Not Applicable
5618	F-15 Protective Systems	7,390	600	700	100	Continuing	Not Applicable
			4,000	6,000	6,200	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the engineering development of new and improved self-protection electronic warfare equipment for tactical strike, air superiority, and reconnaissance aircraft.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for development of various self-protection electronic warfare (EW) systems for tactical strike, air superiority, and reconnaissance aircraft to allow them to accomplish their assigned missions without incurring an unacceptable attrition rate. Self-protection EW equipment includes internally mounted countermeasures systems, electronic countermeasures pods, radar warning receivers, chaff/flare dispensers and expendables and the F-15 Tactical Electronic Warfare System. Cost estimates are based on engineering estimates, statistical data from previous programs and specific contractual data from ongoing development programs.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	14,200	24,600	23,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

(899)

Program Element: #64739F

DOD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Tactical Protective Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The purpose of this program element (PE) is to develop, test, and evaluate electronic warfare (EW) systems for tactical strike, air superiority, and reconnaissance aircraft. Through fiscal year (FY) 1976, this program was limited to the design, development, qualification and evaluation of the ALQ-131 advanced modular electronic countermeasures (ECM) pod. The ALQ-131 can be configured with up to five transmitter modules and a receiver/processor (R/P) module. Increased frequency coverage, power management, and software threat programming provide a greatly enhanced self-protection capability. Production of the

opment of improvements to the F-15 Tactical Electronic Warfare System (TEWS). The efforts associated with the F-15 TEWS are intended to expand the capabilities of the existing warning receivers, jammers and dispensers to counter new or improved Soviet threats. The PE currently includes programs to develop new technology self-protection systems and to improve the capability of inventory radar warning receivers, ECM pods, internal ECM systems and chaff and flare expendables and associated dispensers.

RELATED ACTIVITIES: The efforts in this program draw upon technology developed in various other program elements, (PE), such as PE 64738F, Protective Systems; PE 63718F, Electronic Warfare Technology; and PE 63743F, Electro-Optical Warfare. The F-15 Tactical Electronic Warfare System (TEWS) efforts are directly related to PE 27130F, F-15 Squadrons. Low level development efforts begun in this PE in FY 1979 and FY 1980 have been consolidated under PE 64738F, Protective Systems, and are a major development initiative in that PE in FY 1981 to satisfy

(U) WORK PERFORMED BY: This program element is managed at the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The prime contractor for the ALQ-131 Advanced Tactical Countermeasures Pod is Westinghouse Electric Corporation, Baltimore, MD. The subcontractor for the Improved R/P module for the pod is Loral Electronics Systems, Yonkers, NY. The competing contractors for the ALQ-131 Surveillance Radar Jamming (SRJ) modules are Sperry Microwave, Clearwater, FL and American Electronic Laboratories, Lansdale, PA. The major contractors for the F-15 TEWS are: Northrop Corporation, Rolling Meadows, IL - Internal Countermeasures Set; Loral Electronic Systems, Yonkers, NY - Radar Warning Receiver; Magnavox Company, Ft Wayne, IN - Electronic Warfare Warning Set; and McDonnell Douglas Aircraft Corporation, St. Louis, MO - aircraft integration and Countermeasures Dispenser.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The all development efforts except for the receiver/processor (R/P) during fiscal year 1976. A production decision was made for this configuration in July 1976. In FY 1978 flight testing of the ALQ-131 R/P module was completed. However, new threat data revealed that a capability would be required for effective power management. In FY 1979 the Improved R/P development effort was initiated. Development was initiated of ALQ-131 SRJ modules designed to

Development was completed and flight testing initiated of a cartridge designed to match the of the F-15 aircraft. Development continued of an ALE-40 dual-chaff cartridge containing two separate elements, each having a countermeasure capability equivalent to

Program Element: #64739F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Tactical Protective Systems
Budget Activity: Tactical Programs, #4

one existing chaff unit. This is being done as a cooperative development with the Royal Netherlands Air Force. Development of the F-15 Tactical Electronic Warfare System (TEWS) was completed in FY 1976. A radar warning receiver (RWR) update completed in 1977.
Development of the F-15 countermeasures dispenser (CMD) system was initiated in FY 1979. An RWR enhancement effort to determine appropriate countermeasures for the threats was initiated in FY 1980.

2. FY 1981 Program: Upgrade programs to provide the ALQ-131 electronic countermeasures (ECM) pod with a capability to counter Receiver/Processor (R/P) module for the ALQ-131 will continue. Development will be continued of ALQ-131 surveillance radar jamming (SRJ) modules designed to jam

cartridge designed to match the of the F-15 aircraft. Development will continue of an ALE-40 dual-chaff cartridge. Initial planning for the development of an capability will begin. Initiate development of the next generation ECM pod with the goal of incorporating Airborne Self Protection Jammer (ASPJ) technology to replace aging inventory ALQ-119 pods. A flare development effort will be initiated. The efforts to upgrade the F-15 Tactical Electronic Warfare System (TEWS) will be continued. A study that will identify to the Electronic Warfare Warning Set (EWWS) will be completed. A radar warning receiver (RWR) enhancement program will be initiated. The countermeasures dispenser development program will continue.

3. FY 1982 Planned Program: The development efforts initiated in FY 1981 and prior years, for electronic countermeasures (ECM) systems, radar warning receivers (RWR) and chaff/flare dispenser systems will be continued. A task to determine the redesign needed to adapt available for use with the A-10 aircraft will be started. The development of the ALE-40 dual-chaff cartridge, done as a joint United States/Netherlands effort will be completed. The development of a flare designed to match a variety of aircraft will be continued. The development of the Improved Receiver/Processor (R/P) for the ALQ-131 ECM Pod will be completed. The development of a capability for integration into inventory RWRs will be initiated. The F-15 TEWS upgrade effort will be continued. Flight testing of the countermeasures dispenser will be completed. The funding increase in FY 1982 is the result of factoring for inflation.

4. FY 1983 Planned Program: The development efforts initiated in FY 1982 and prior years for electronic countermeasures systems, radar warning receiver systems and chaff/flare dispensers will be continued. The development of an system

will continue.

5. (U) Program to Completion: This is a continuing program to develop new systems or to update existing electronic countermeasures capabilities to counter new or improved Soviet defensive weapon systems.

6. (U) Milestones: Not Applicable.

Project: #2272

Program Element: #64739F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Active Countermeasures Systems

Title: Tactical Protective Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This project provides for the development of improved electronic countermeasures (ECM) capability for inventory ALQ-131 ECM pods and for the development of new ECM capabilities, to include detection, for tactical strike and reconnaissance aircraft. Updates to existing systems are required to

The continued improvement in the quantity, quality, and diversity of creates a continuing need to improve the self-protection countermeasures capability for tactical strike and reconnaissance aircraft.

(U) RELATED ACTIVITIES: The efforts in this project build upon feasibility concepts and techniques demonstrated in Program Element (PE) 63718F, Electronic Warfare Technology and PE 63743F, Electro-Optical Warfare. Techniques and technology from PE 64738F, Protective Systems, that satisfy similar requirements for other aircraft will be utilized.

(U) WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The prime contractor for the ALQ-131 Advanced Tactical Countermeasures Pod is Westinghouse Electric Corporation, Baltimore, MD. The subcontractor for the Improved Receiver/Processor (R/P) module for the ALQ-131 ECM pod is Loral Electronics Systems, Yonkers, NY. The competing contractors for the ALQ-131 Surveillance Radar Jammer (SRJ) modules are Sperry Microwave, Clearwater FL, and American Electronic Laboratories, Landale, PA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Development of the electronic countermeasures (ECM) pod was completed production started in Fiscal Year 1976. Development testing of the original receiver/processor (R/P) module to provide power and resource management for the ALQ-131 ECM pod was completed in FY 1978. However, additional analysis revealed that a capability was required to counter the latest Soviet radar threats. In FY 1979 an Improved R/P program was initiated to incorporate this capability. Competitive development of ALQ-131 Surveillance Radar Jammer (SRJ) modules designed to jam radars to degrade was initiated in FY 1980.
2. FY 1981 Program: Development of the ALQ-131 Improved R/P will continue and flight testing will begin. Phase I of the ALQ-131 SRJ program will complete, at which time a military worth decision will be made before proceeding into Phase II with a single contractor. Electronic countermeasures (ECM) improvement programs to provide ALQ-131 ECM Pod with a capability against Jamming techniques, effective radiated power, command, control and communication (C3) countermeasures and reliability and maintainability will be addressed in an overall effort to make the pod more effective against operationally deployed and postulated Soviet threat radars. Begin initial planning for the development of an Initiate development of the next generation ECM pod with the goal of incorporating Airborne Self Protection Jammer (ASPJ) technology to replace the aging inventory ALQ-119 pods.
3. (S) FY 1982 Planned Program: The ECM improvement programs initiated in FY 1981 and prior years will be continued. Development of the ALQ-131 Improved Receiver/Processor will complete and limited production will start.

Project: #2272

Program Element: #64739F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Active Countermeasures Systems

Title: Tactical Protective Systems

Budget Activity: Tactical Programs, #4

Phase II full scale engineering development by a single contractor will begin on the ALQ-131 Surveillance Radar Jammer (SRJ) modules. ALQ-131 electronic countermeasures (ECM) pod improvement/enhancement programs will continue with the goal of incorporating, incrementally, new capabilities into the pod production line to expedite the fielding of a more effective self-protection pod for the tactical forces. Initiate full scale engineering development of the

replace aging inventory pods.

Continue development of a next generation ECM pod to

4. (U) FY 1983 Planned Program: The ECM development efforts initiated in FY 1982 and prior years will be continued. Hardware and flight test of the ALQ-131 SRJ modules will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	8,356	19,600	13,600	11,500	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

RDT&E

7,500	15,900	10,400	Continuing	Not Applicable
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(U) FY 1982: The increase of \$3,200 thousand represents a realignment of funds within the program element to fund higher priority programs.

Project: #5618

Program Element: #64739F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: F-15 Protective Systems

Title: Tactical Protective Systems

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for development of electronic warfare (EW) equipment for the F-15 aircraft. The F-15, in its counter-air role, will be required to operate in the presence of hostile ground controlled fighter interceptors, surface-to-air missiles and anti-aircraft artillery. With respect to enemy fighter aircraft, the F-15 pilot must be alerted to the presence of the enemy aircraft so that he can achieve a favorable attack position. With respect to enemy anti-aircraft ground defenses, the F-15 must be sufficiently protected to be able to escort friendly ground attack forces into enemy held territory and to be able to pursue enemy fighters into and over their own defended territory. A combination of warning devices, jammers, and decoys have been selected to degrade the capabilities of the enemy electronic defense systems.

Work efforts within this project accomplish the necessary research, development, test and evaluation to expand the capabilities of the existing warning receivers and jammers to counter new or improved threats. Also included is the development of a chaff/flare dispenser to provide improved capability to counter threats. The current configuration consists of a Radar Warning Receiver (RWR), Electronic Warfare Warning Set (EWWS) and an Internal Countermeasures Set (ICS). A Countermeasures Dispenser (CMD) set will be added to this configuration. Collectively, these four subsystems are known as the F-15 Tactical Electronic Warfare System (TEWS). A previous Project (2073) for development of the new subsystem was folded into this project, to provide for more effective Air Force management.

(U) RELATED ACTIVITIES: The work under this project is directly related to program element (PE) 27130F, F-15 Squadrons, which provides for procurement of the F-15 TEWS as part of the F-15 Weapons System. Technology developed in PE 63718F, Electronic Warfare (EW) Technology, and PE 63743F, Electro-Optical Warfare, provides the basis for improvements to counter new threats. Close coordination occurs between this project and other aircraft EW programs within this program element and programs in PE 64738F, Protective Systems. For example, the CMD will use identical chaff and a variation of the flares and the dispenser developed in this PE for other tactical aircraft.

(U) WORK PERFORMED BY: The Air Force manager is the Aeronautical Systems Division, Wright-Patterson, AFB, OH. Major contractors are: Defense Systems Division of the Northrop Corporation, Rolling Meadows, IL - ICS; Loral Electronics Systems, Yonkers, NY - RWR; Magnavox Company, Fort Wayne, IN - EWWS; and McDonnell-Douglas Aircraft Corporation, St. Louis, MO - Aircraft Integration and the CMD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Development of the Radar Warning Receiver (RWR), Electronic Warfare Warning Set (EWWS) and Internal Countermeasures Set (ICS) began in Fiscal Year (FY) 1971 and was completed in FY 1976. AN RWR threat related improvement was initiated in FY 1976 and completed in FY 1977. Development of a capability for the RWR was initiated in FY 1977 to improve and was completed during FY 1980. During FY 1977 a major update to the F-15 TEWS was started. This development program increased the and

Project: #5618

Program Element: #64739F

DOD Mission Area: Electronic Warfare and Counter-C3, #257

Title: F-15 Protective Systems

Title: Tactical Protective Systems

Budget Activity: Tactical Programs, #4

This program was terminated at the end of fiscal year (FY) 1980 after completion of integration and simulator testing. In FY 1979 an improvement to the Electronic Warfare Warning Set (EWWS) to provide

Development of the Countermeasures Dispenser Set (CMD) was initiated in FY 1979. During FY 1980 development of a modular Operational Flight Program for the Radar Warning Receiver (RWR) was initiated. In late FY 1980 an RWR Enhancement study effort was initiated to provide recommendations on countering threats. The New Threats RWR hardware started production in FY 1980 with initial deliveries scheduled for FY 1981.

2. FY 1981 Program: The modular Operation Flight Program for the RWR and the CMD will complete flight test. The fleetwide retrofit of the New Threats RWR hardware will commence. The RWR memory expansion from will be initiated. An RWR Enhancement development program will be initiated based on the results of the study. The CMD Enhancements effort will continue in development.

3. (U) FY 1982 Planned Program: The flight test of the Countermeasures Dispenser (CMD) Enhancements will be completed. The Radar Warning Receiver (RWR) memory expansion will be tested, to include flight testing. The RWR Enhancement development and the New Threat retrofit will continue.

4. (U) FY 1983 Planned Program: The RWR Enhancement program will undergo simulator and flight testing. Planning will be initiated for the retrofit of the CMD, low band direction finding, and the Enhanced RWR programs.

5. Program to Completion: New or improved capability efforts initiated to the F-15 Tactical Electronic Warfare System (TEWS) as required, to avoid obsolescence. will be monitored and improved

requiring corresponding improvements to the F-15 TEWS.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
RD&E	7,390	4,000	6,000	6,200	Continuing	Not Applicable

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

	5,400	6,000	6,000	Continuing	Not Applicable
RD&E					

824 915 906B 1706P

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64740F

Title: Computer Resource Management Technology*
Budget Activity: Tactical Programs, #4

DOD Mission Area: Tactical Command and Control, #254

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2239	Computer Security Technology	3,800	4,470	6,000	7,000	Continuing	Not Applicable
2522	Requirements Analysis	1,340	1,600	1,200	2,400	Continuing	Not Applicable
2523	Management Control Technology	670	300	800	900	Continuing	Not Applicable
2524	Policy and Procedure Guidance	190	250	400	400	Continuing	Not Applicable
2526	Software Engineering Tools and Methods	600	900	1,500	1,300	Continuing	Not Applicable
2652	Computer Architecture Standards	1,000	1,250	1,400	1,300	Continuing	Not Applicable
			170	700	700	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF THE ELEMENT AND MISSION NEED: Air Force and Department of Defense studies have shown that the rapidly increasing cost of computer software diverts resources from other vital mission requirements. The increasing complexity of the threat has forced an increase in mission complexity and increased proliferation of digital computers and computer software. The current Department of Defense computer software cost in excess of \$4 billion per year is rapidly growing and this growth must be brought under control. The goal of this program is to apply technology in the system acquisition and maintenance process in order to reduce the life cycle costs of software and improve the quality of operational defense weapon system software by the Mid-1980s. This program is part of a joint service effort coordinated under the Office of the Secretary of Defense Management Steering Committee for Embedded Computer Resources and, as such, is responsive to Department of Defense wide deficiencies.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Computer Resources Management Technology Program is part of the joint Defense System Software Research and Development Technology program to overcome deficiencies in the development, acquisition, operation, and support of embedded computer resources. The primary thrusts of the program lie in the following six areas: (1) computer security technology; (2) requirements analysis; (3) management control technology; (4) policy and procedure guidance (5) software engineering tools and methods; and (6) computer architecture standards. The FY 1982 objectives are: (1) the application of advanced developments in computer engineering and associated management procedures (2) the development and application of techniques to reduce the cost and increase the performance of complex systems; (3) the provision of tools and techniques which improve acquisition practices to developers, maintainers, and users; and (4) the provision of management techniques which improve visibility and control of computer system development.

(U) Comparison with FY 1981 Budget Data:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	3,780	5,800	6,800	8,000	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

* Formerly titled Applications of Information Processing Technology

Program Element: #64740F

DOD Mission Area: Tactical Command and Control, #254

Title: Computer Resources Management Technology

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Computer technology has become central to the Air Force's ability to perform its role and mission. The management of this vital resource and its associated costs presents a major challenge to the Air Force. The Computer Resource Management Technology (Program Element 64740F) program, an Air Force-wide computer engineering development effort, was established to apply technically advanced solutions to the problems associated with management of computer resources used in Defense systems, and achieve overall improvement in the performance/cost ratio of these Air Force computer resources. This program, consisting of some 40 different tasks, will exploit the results of advanced development programs in computer resources technology; develop and apply techniques to reduce the cost and increase the reliability of complex automated Defense systems; and provide the user and system designer with improved computer equipment, programming techniques, and information processing tools for specification, design, testing and support of automated Defense systems. To be addressed are deficiencies identified in the use and control of high order languages, the application and engineering approach to computer software development, the use of requirement and cost analyses, the application of comprehensive acquisition management procedures, and the transfer of multi-level computer security technology into the industrial and Department of Defense community.

(U) CURRENT PROJECTS IN THIS PROGRAM INCLUDE:

Project Number:

Title

2239

(U) Computer Security Technology: This project provides for a technology transfer program to foster the wide-spread availability of multi-level computer security technology and validation techniques to industry and into Department of Defense systems. The work is responsive to the Department of Defense Computer Security Initiative Task and falls into four categories: (1) Department of Defense Computer Security Consortium Support; (2) ad hoc program office support; (3) "trusted" (provable) system development and demonstrations; and (4) verification procedures. The computer security work sponsored through Program Element 64740F has wide-spread application. Among Air Force program offices with computer security requirements are Strategic Air Command Digital Information Network (SACDIN), Operational Application of Special Intelligence Systems (OASIS), Automatic Digital Information Network II (AUTODIN II), Space Defense Operation Center (SPADOC), SEEK SCORE, IASA, EIFEL II, and MX. Additionally, the tasks are addressing requirements specified in SAC ROC 1-74, MAC ROC 6-75, USAFE GOR 1-78, and findings in the Air Force Audit Agency directed Computer Fraud Study which resulted from OMB-A/71 and recommendations of the Department of Defense Oversight Committee. This critically important effort represents a continuing commitment to computer system security as an integral part of military security.

2522

(U) Requirements Analysis: This project develops and applies tools that provide the system developer rapid insight into the technical implications of stated system requirements on computer resources. These tools are used to identify costs, risk areas, and explore implementation alternatives before making computer resources schedule and financial commitments. Work has been successfully accom-

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Program Element: #64740F

DOD Mission Area: Tactical Command and Control, #254

Title: Computer Resources Management Technology

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published with the Computer Aided Design and Specification Analysis Tool in the E-3A and SACDIN Program Offices. An estimated \$700,000 savings was attributed to the use of Computer Aided Design and Specification Analysis Tool in the E-3A Program Office alone. A new initiative, the Automated Interactive Simulation Modeling, represents the latest effort to focus on an "easy to learn, simple to use" approach. Using a menu of parameters, the system engineer builds a "model" of his system configuration, process, and performance to aid in design/tradeoff analyses. The desired result is to explore optimum system design in terms of cost and performance. All automated tools and procedures developed under this project are directed at improving the requirements definition/analysis phase of military system acquisitions.

2523

(U) Management Control Technology: This project is directed towards developing and applying information system tools and techniques to improve the processes of planning and controlling the acquisition of systems with embedded computer resources. This project includes developing and evaluating techniques and tools for computer system timing and sizing estimating. These techniques have been used in resource estimates for the SEEK SCORE, Air Weather Distribution System (AWDS), Joint Tactical Information Distribution System (JTIDS), Battlefield Exploitation and Target Acquisition (BETA), Base and Installation Security System (BISS), Automated Technical Control (ATEC), and System Test and Exercise Module (STEM) Programs. Also being accomplished is the application of software quality metrics, an approach to quantify software quality in defense systems. A recent effort will examine eleven (11) software quality factors (transportability, maintainability, etc.) developed by a major defense contractor and apply them to an actual system acquisition. Management control and visibility will be enhanced through these "yardsticks" on quality.

2524

(U) Policy and Procedure Guidance: This project will develop and recommend to AFSC comprehensive, specific standards and procedures to guide the acquisition and support of computer resources. This project includes development of guidebooks, training media, and Computer Technology Transfer Training Center in software acquisition management. During FY 1981, the Air Force will spend more than \$1.6 billion on the acquisition of software. More than 60% of Air Force personnel managing these acquisitions are Second Lieutenants. The Computer Technology Transfer Training Centers effort will develop courses, materials, techniques and programs to provide the latest training in software acquisition which will be used throughout the Air Force to reduce an estimated 30% shortfall in skilled computer system acquisition managers. Already, over 70 personnel have received training at the Electronic Systems Division, Hanscom Air Force Base prototype Computer Technology Transfer Training Centers and are making positive contributions in their acquisition management duties.

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Program Element: #64740F

DOD Mission Area: Tactical Command and Control, #254

Title: Computer Resources Management Technology

Budget Activity: Tactical Programs, #4

2526

(U) Software Engineering Tools and Methods: This project will develop and apply a comprehensive, integrated set of engineering tools to improve the software development and acquisition processes. Special emphasis will be directed toward the configuration management, documentation, training, and support necessary to result in a viable transfer of the new technology to the program offices. Supported under this project are such tasks as the J73 Language Control Facility, the National Software Works, and Ada, the new Department of Defense Standard High Order Language system support. The J73 Language Control Facility will validate languages for the following systems which have made a commitment to the J73 High Order Languages: CX, Advanced Tactical Fighter, Low Altitude Navigation Targeting Infrared for Night (LANTIRN), Digital Integrating Subsystem (DIS), Advanced Medium Range Air-Air Missile (AMRAAM), and MX. The National Software Works effort will demonstrate the inter-netting of computers and tools to support developers, maintainers, and users of computer systems. Software tools on the National Software Works are planned to support a programming application for demonstration at a selected Air Force Logistics Command Air Logistics Center. Ada system support will involve rehosting and retargeting of the Ada compiler and software support environment for Air Force system(s).

2652

(U) Computer Architecture Standards: This project is to support development of tactical command, control and communication and space systems by stabilizing the software development environment, using high order languages, and facilitating interoperability. Work will initially center on defining Air Force requirements for the MIL-STD-1862 (NEBULA) 32-bit Computer Instruction Set Architecture developed by the Army. Specifically, command, control, communication and intelligence and ground-based space system requirements will be identified and recommended to the Joint NEBULA Control Board. The work is in concert with recent DOD initiatives on standardization within the military community and is aimed at reducing the proliferation of computer architecture and thereby improving maintainability and reduced acquisition costs.

(U) RELATED ACTIVITIES: This program supports and is responsive to the DOD Defense Computer Resource Technology Plan and the DOD High Order Computer Language Commonality Program. It is related to other programs which constitute the DOD Software Science and Technology Program: 62701A, Communications Electronics; 62725A, Computer and Information Sciences; 63723A, Automatic Data Processing Equipment Development, 62721N, Command and Control Technology; 63526N, Advanced Computer Technology; 62708F, Distributed Information Systems; 62702F, Command, Control and Communications; 62204F, Aerospace Avionics; and 63728F, Advanced Computer Technology. Air Force thrusts generally transition into this program from 63728F and are coordinated through technical reviews at the staff and engineering levels. Coordination with other Services is achieved through the DOD High Order Language Working Group, the Research and Development Technology Panel of the Management Steering Committee for Embedded Computer Resources and annual DOD apportionment reviews.

(U) WORK PERFORMED BY: The Electronics Systems Division (ESD) Hanscom AFB, MA has management responsibilities for the program. Contractors include the System Development Corporation, Santa Monica, CA; TRW, Redondo Beach, CA; Boeing Computer Services, Seattle, WA; Logicon Inc., Bedford, MA; Doty Associates, Inc., Rockville, MD; Denver Research Institute, Denver, CO; System Architecture Inc., Randolph, MA; Softech Inc., Dayton, OH; ITT Research Institute, Rome, NY; SRI

Program Element: 64740F

DOD Mission Area: Tactical Command and Control, 3254

Title: Computer Resources Management Technology
Budget Activity: Tactical Programs, 34

International, Menlo Park, CA; Martin Marietta Aerospace, Denver, CO; Hughes Aircraft Company, Fullerton, CA; Systems & Applied Science Corporation, Riverdale, MD. System engineering support is being provided by MITRE Corporation, Bedford, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Major achievements of this program element have included: (1) The Department of Defense Computer Security Technical Consortium produced a draft specification for development and certification of trusted (secure) systems for DOD applications. This specification is being reviewed within DOD and industry, and a formal specification will be developed. (2) An initial demonstration of the capabilities and functional operation of the Kernelled Virtual Machine/370 (KVM/370) was held at the Air Force Weapons Laboratory. (3) The Computer-Aided Design and Specification Analysis Tool (CADSAT) was successfully applied for the E-3A and Strategic Air Command Digital Information Network (SACDIN) Program Offices. This tool was used to analyze the impact of an Engineering Change Proposal and trace interfaces between Computer Program Configuration Items. Numerous design oversights were identified with a significant savings of money and development time for the Government. (4) CADSAT was transferred to the Federal Software Exchange, making the tool available throughout the federal government. (5) Development was begun on the Automated Interactive Simulation Modeling System (AISIM). This prototype simulation for command, control and communications systems will (i) simulate operational concepts and be able to aid design tradeoff studies for limited hardware/software configurations, (ii) use an automated data base management system created from the initial system requirements, and (iii) create a structured requirements data base as a result of interactive simulation. The second phase of the effort will consist of testing the modeling system with an Electronic Systems Division (ESD) program office to determine its modeling capabilities with a real system. The third phase of the effort will consist of enhancements and modifications from experience gained, along with rehosting the system on a government computer with terminals in ESD program offices. (6) A handbook of procedures for estimating computer system sizing and timing parameters was produced. This handbook will assist acquisition personnel Air Force-wide in defining requirements and evaluating proposals. The contract has been extended to include development of a videotape for educational use in transferring this technology to engineers and managers involved in acquisition. (7) The prototype facility of the Computer Technology Transfer Training Center (CT³C) was completed. This initial facility, the first of a series for each product division of Air Force Systems Command (AFSC), is located at ESD. More than 70 students have already completed courses in "Fundamentals of ESD Systems Acquisition". Contractor-designed courseware modules on "Computer Program Development Plan" (CPDP) and "Computer Resource Integrated Support Plan" (CRISP) have been delivered. (8) The JOVIAL Higher Order Language (HOL) Control Prototype Facility became operational. This facility will establish, operate, and "shakedown" the tools and procedures for controlling the JOVIAL HOL. The facility will initially operate at Rome Air Development Center (RADC) and then be transferred to Aeronautical Systems Division (AFSC). The Language Control Facility will provide for the specification and maintenance of the approved JOVIAL MIL Standards, will establish and maintain a data base on JOVIAL users, compilers, and support tools, will assist in the acquisition, development, and maintenance of JOVIAL compilers for conformance to the MIL Standards, and will provide a center of expertise on the JOVIAL language. All tools and operating procedures used in the control of JOVIAL will be documented in a form such that the responsibility

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ities and functions of the Language Control Facility can be transferred to ASD the second quarter of FY 1981. (9)

Draft copies of the final fifteen guidebooks for Software Acquisition Engineering in Avionics and Ground-Based Systems are in Air Force review. Eight videotapes of topics in Software Acquisition Management have been delivered. These training materials, along with already developed guidebooks, will be used to train new software acquisition managers throughout AFSC. (10) Draft Copy of the Software Acquisition Management guidebook on the System Specification was delivered and is currently in printing.

2. (U) FY 1981 Program: As the result of a Congressional reduction from \$5.9 million requested in the FY 1981 President's budget to \$4.5 million, five of 27 tasks planned for FY 1981 were unfunded. The FY 1981 restructured program provides for the following efforts. Operational, Test and Evaluation of a secure, multi-level computer system (Kernelized Virtual Machine 370) will be conducted in selected DOD applications. Enhancements and applications of "trusted" system design and verification will be accomplished through the addition of security monitoring and accounting procedures. Three computer security specification/verification methods will be analyzed from their human engineering suitability aspects. Support to the DOD Computer Security Consortium to transition secure computer systems to protect classified and private information will continue. Limited ad hoc support to USAF Program Offices for system specification assistance and technical support will be provided. The automated general purpose modeling capability, Automated Integrative Simulation Modeling System (AISIM), will undergo pilot application testing in an Air Force program office Base and Installation Security (BISS). Other requirements analysis tasks will be delayed. Within the Management Control Technology Project, a task to support the Joint Logistics Commanders' joint service requirement to revise and consolidate Army, Navy, and Air Force acquisition and documentation standards into a single, unified set will be initiated. The Computer System Acquisition Metrics task, which applies software quality factors in an acquisition environment, will be started. The products will be a user-oriented handbook on software quality and training material on the application of the factors. The Policy and Procedure Guidance Project will embrace tasks for the development of a computer resource general specification handbook for the avionics community and continuation of courseware development for the Computer Technology Transfer Training Center (CT³C). Computer aided instruction (CAI) and computer managed instruction will be developed for selected acquisition processes, e.g., preparation of the Statement of Work, the Computer Program Development Plan, etc. Training materials and video tapes will be incrementally transferred to Air Force Systems Command participants in the CT³C development. Within the Software Tools and Techniques Project, the High Order Language Control Facility for JOVIAL J73 language control will be transferred to a fully operational status and begin validating compilers in support of the MX missile, Advanced Medium Range Air-to-Air Missile (AMRAAM) and the Army Pershing Missile Program. Follow on enhancements to JOVIAL J73 compilers, development tools and validation aids will be undertaken to insure use of and conformance to this single JOVIAL standard as directed by Department of Defense (DOD) Instruction 5000.31. Work planned for the National Software Works (tool implementation, information/operations center support, tool bearing host development and Air Force Logistics Command technology demonstrations) will be delayed. Finally, Air Force command, control, communications and intelligence requirements for the MIL-STD-1862 (NEBULA) 32-bit instruction architecture will be examined and recommended to the joint NEBULA Control Board. Additionally, requirements for a standard instruction set architecture for space systems will be defined using PE 64740F funds.

Program Element: 64740F

DOD Mission Area: Tactical Command and Control, 5254

Title: Computer Resources Management Technology
Budget Activity: Tactical Programs, 54

3. (U) FY 1982 Planned Program: The Program Element will continue to support DOD computer security initiatives evaluating commercially developed "trusted" computer systems and Air Force program offices specifying computer security requirements. Enhancements to the Kernelized Virtual Machine 370 multi-level secure system will be accomplished to address special security requirements and independent proof analysis. Certification and documentation of the KVM 370 multi-level secure system is expected in the May-Aug 1982 time frame. Financial support for computer security work originally scheduled for FY 81 will be provided. This support includes the Korean Air Intelligence System Secure Interface for the U.S., the Military Airlift Command requirements study for a secure data base management system and efforts to assist the Air Force Audit Agency/Air Force Accounting and Finance Center in developing and verifying computer security policies for asset management. Automated tools and procedures development in requirements analysis will continue with the rehost of the AISIM capability on a government computer and, later, transfer of this automated modeling aid to Air Force program offices through on-site interactive terminals. Two new requirements analysis tools, the Document Writer and the Automated Requirements Development System, will be used in program offices to generate and maintain acquisition documents (system specifications, statements of work, etc.). The Software Development and Acquisition Standards task, supporting the Joint Logistics Commanders' requirements will continue with Joint Data Item Descriptions (DID) being produced. Incremental transfer of training materials developed for the Computer Technology Transfer Training Center (CT3C) will continue. The Training and Performance Support system, which provides the hierarchy of general to detailed training will be completed. Computer System Acquisition Management Guidebooks will be updated. The National Software Works (NSW) effort, delayed in FY 1981, will be resumed. The use of the NSW technology to save software maintenance cost will be evaluated in two different Air Logistics Center operational environments. Software support facilities such as those serving the F-15, E-3A and F-111 will be linked for access and sharing of software maintenance tools. The most promising results will be pursued as the basis for high-level demonstrations of the NSW in FY 1983. Planning efforts will be started to identify the most promising program candidates for the high payoff introduction of the Ada High Order Language into an Air Force system acquisition. The Computer Architecture Standards project will continue with emphasis on the 32-bit, Ada-efficient instruction set architecture. The architecture will be responsive to command, control and communications applications requiring multi-level security, networking and fault tolerance. Tools for the software development and maintenance environment of the 32-bit instruction set architecture will be defined and developed.

4. (U) FY 1983 Planned Program: Multi-level computer security efforts will continue and emphasize involvement of the part of the commercial sector by showing industry that security integrity can be achieved. The efforts of the DOD Computer Security Technology Consortium are a primary vehicle to stimulate transfer will be supported. Operational demonstrations and certifications of secure systems will be conducted. Proven requirements analysis tools will be transferred to a support facility. Training materials on requirements analysis tools, procedures and applications will be developed. Work will be initiated on developing man-machine interface guidelines for systems with interactive terminals. New guidebooks and training materials for software quality assurance, independent verification and validation, microprocessor technology and software cost estimation and measurement will be developed. Computer system metric standards (to

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Program Element: 64740F

DOD Mission Area: Tactical Command and Control, 5254

Title: Computer Resources Management Technology
Budget Activity: Tactical Programs, 54

assure the cost-effective application of metrics) will be produced. Training material development and refinement for the CT3C will continue. Courseware will be incrementally transferred to CT3C and Air Force Systems Command Product Divisions as it becomes releasable. The Ground and Air System Acquisition Engineering Guidebooks will be updated. Efforts in support of the common DOD High Order Language will be continued. The Air Force Logistics Command operational demonstration of the National Software Works will be completed. Support for Air Force interests in a DOD standard Instrucon set architecture will continue. Standard DOD and USAF directions on computer architecture will be updated and Ada applications investigated.

5. (U) Program to Completion: While specific tasks will conclude, the level of effort will continue as new technology initiatives are started.

6. (U) Milestones:

	Date
a. JOVIAL Control Facility Transition	Jan 1981
b. NSW Tool Bearing Host Completed	Mar 1981
c. Computer Security Verification Technology Applied	Jul 1981
d. Computer Systems Metrics Handbook Completed	Sep 1981
e. Automated Requirements Development System Transfer to Program Office	Oct 1981
f. Evaluation of Ada for JTIDS Class II Terminals	Oct 1981
g. Computer System Acquisition Metrics Handbook Completed	Dec 1981
h. Demonstration and Certification of Operational KVM Multi-Level Secure	Mar 1982
i. AISIM-Rehost on Government Computer	May 1982
j. AISIM-Transfer Capability	May 1982
k. AFLC NSW Demonstration	Aug 1982
l. Complete DOWRITER Capability	Oct 1982
Operating System and KAIS Security Interface	
m. C-1 and Space Instruction Set Architecture Evaluation	Mar 1983
n. Ada Compiler and Support Environment Demonstration	Jul 1983
o. GFP of Total Ada Environment	Jul 1984
p. Secure AFLC Network Demonstration	Aug 1984
q. CT3C Fully Developed and Transferred to Product Divisions	Sep 1984
r. Design Handbook for Man-Machine Interfaces in USAF C3 Systems	Jun 1985
s. Automated Alternative Decision Analysis	Jul 1986
t. Automated Advanced System Requirements Analysis	Aug 1986

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C3 #257 Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECTED LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	15,000	14,850	83,100	77,700	102,700	478,750
1190	Precision Location Strike System (PLSS)	12,100	14,750	82,500	77,100	102,700	428,150 1/
1947	Emitter Location System (ELS)	900	0*	0	0	0	6,200
1949	Advanced Location Strike System (ALSS)	700	100	600	600	0	39,400
2589	Joint Service Weapon Data Link (JSWDL)	1,300	0*	0	0	0	3,700

* Continue required development as part of PLSS, Project 1190. 1/ Includes \$0.4M for Coherent Emitter Location Testbed (CELT)

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Soviet/Warsaw Pact forces are projected to continue to significantly increase their air defenses in quantity, quality, mobility and countermeasures capabilities in support of 24 hour-a-day forces operations. The objective of this Program Element is to develop and test a tactical strike system designed primarily to suppress enemy air defenses. This system is the Precision Location Strike System (PLSS). When deployed, a triad of TR-1 aircraft equipped with PLSS equipment will collect hostile

Following the selection of air defense targets, a hardened PLSS ground station will direct the attack force to the targets by anti-jam data link commands relayed through the TR-1s. The strike element can be aircraft, standoff guided weapons, or Army artillery. The system provides 24 hour theater wide suppression of enemy air defenses in any weather and will thereby lower aircraft losses and increase sortie effectiveness. This capability,

is rated by the 1977 Air Force/Army Tactical Reconnaissance Force Mix Study as number one in value to the tactical commander and the highest priority system in terms of cost versus payoff.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Design of the Precision Location Strike System hardware and software will be finalized through the Critical Design Review process. In addition, subsystem element hardware fabrication will continue. Coding, debugging and testing of system software will continue and development of peculiar support equipment (PSE) will be initiated. Advanced Location Strike System (ALSS) will support the Research, Development, Test and Evaluation (RDT&E) efforts for Precision Location Strike System (PLSS) risk reduction and tactical demonstrations/exercises. Elements of ALSS will be used to support Assault Breaker/Pave Mover test and demonstration.

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

The Joint Service Weapon Data Link (JSWDL) is being developed to provide anti-jam guidance of weapons using distance measuring equipment (DME), television (TV) and imaging infrared (IIR) techniques as well as hybrid combinations of these. Cost estimates are based on negotiated contract and changes.

(U) Comparison with FY 1981 Descriptive Summary:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
RDT&E	15,000	62,600	60,800	-	55,900	379,700
Procurement (Aircraft) (PE 27244F)			8,200	-	259,400	267,600
Procurement (Other) (PE 27244F)					67,600	67,600

(U) OTHER APPROPRIATION FUNDS: * (\$ in thousands)

Other Procurement

2,100 5,600 7,700*

* Funds shown here for reference will be in Program Element 27244F, Location Strike System and will be for augmentation and upgrade of the development system to an operational status. One complete PLSS system plus an additional ground station for training and deployment will be procured. Funds for the TR-1 airborne relay vehicles (ARV) will be procured in the TR-1 procurement program element, 27215F. All TR-1s will be capable of carrying either the PLSS equipment or the TR-1 reconnaissance equipment.

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Precision Location Strike Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Soviet/Warsaw Pact tactical doctrine emphasizes a 24-hour a day capability with a strong emphasis on protection of ground forces using air defense systems to reduce the effectiveness of airpower. Defense Intelligence Agency document, "Precision Location Strike System (PLSS) Electronics Warfare Threat Through 1990," June 1977, projects trends of

Current and projected Air Force and Army systems will
All weather operations are constrained by accurate weapons with
all weather weapons systems are constrained by
within the lethal range of the enemy air defense systems.

threat.
capability while

Delivery of weapons is primarily from
Current reconnaissance systems lack the ability to

The development of the Precision Location Strike System (PLSS) will substantially alleviate any of the critical deficiencies in our all-weather tactical defense suppression close air support interdiction attack capabilities and will enhance our reconnaissance capabilities. The Advanced Location Strike System (ALSS) is the predecessor system which supports continued development of operational concepts for a PLSS system by the Tactical Air Command and serves as a Research, Development, Test and Evaluation (RDT&E) testbed for PLSS risk reduction efforts.

(U) The PLSS project is a major program development effort. PLSS will provide targeting-accuracy, integrated location and strike of hostile air defenses continuously in near real time and all weather over a theater-wide area. As such, PLSS will be the centerpiece to efficient and effective conduct of lethal defense suppression to reduce attrition to acceptable levels, especially, in the critical first few days of conflict. Additionally, PLSS can provide up to the minute Electronic Order of Battle information enabling the commander to assess the immediate threat to his strike force.

The PLSS will provide a
radar systems and a

circular error probable (CEP) location accuracy against air defense
CEP location accuracy against broadband jammers.

Once processed and identified, the system relays target information to the appropriate Air Force or Army battlefield commander

Emitter target location is accomplished by using time-difference-of-arrival and direction-of-arrival-techniques. Identification of emitter type
is accomplished from comparison with known parameters. New signals are used to update the electronic order of battle data. Further identification to is being developed as a part of the Precision Location Strike System (PLSS). The PLSS will be capable of operating in the dense emitter signal environment projected for Europe through 1990.

#64742F

DoD Mission Area: Electronic Warfare and Counter-C3, #257 Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

Attacks on radiating and nonradiating targets will be with standoff guided weapons or with conventional ordnance using the PLSS Distance Measuring Equipment (DME) precision guidance. Use of DME guided standoff weapons significantly reduces the attrition of attacking forces from surface-to-air missile/anti-aircraft artillery (SAM/AAA) defenses. The PLSS will allow circular error probable (CEP) guidance accuracy giving a total system accuracy (location/strike) of less than emitters. Using DME units on attacking aircraft will also reduce attrition through increased probability of target kill on the first pass. The PLSS can direct unguided ordnance delivery within an CEP of the target location. The DME guidance data link being developed will provide PLSS with high anti-jam protection to counter the Defense Intelligence Agency (DIA) projected threat environment.

(U) Full Scale Engineering Development of the PLSS was initiated in September 1977 after review by the Defense System Acquisition Review Council and approval by the Deputy Secretary of Defense. It is the USAF intent to request reprogramming authority to replace FY 1981 funds taken both in the amendment of the President's 1981 Budget and in the Congressional Appropriations Bill.

The Emitter Location System (ELS), Project 1947, was being developed to accurately locate for attack accuracy

The addition of ELS as an integrated subsystem of PLSS would give the Air Force the total capability for accurate location and all-weather attack of the full range of emitting enemy air defense systems. The ELS approach uses

and has been pursued as a separate effort. The technology has rapidly advanced and the ELS capability can be integrated into PLSS through a phased approach to achieve location

The ELS technology has been validated and demonstrated in the Coherent Emitter Location Testbed (CELT). Other than the capability to locate which has been incorporated in the PLSS, ELS has been deferred due to lack of funds.

The Advanced Location Strike System (ALSS), Project 1949, is the predecessor system to PLSS. The ALSS was designed to quickly deploy to Southeast Asia (SEA) in 1972 to locate and destroy sites. Those hostilities ceased before ALSS was deployed; however, it was deployed to Europe for operational test and evaluation. The known limitations (limited frequency coverage and weapons control, vulnerabilities to countermeasures, etc.,) precluded introduction of ALSS into the operational inventory. Studies concluded that it was not cost-effective to modify ALSS to meet the PLSS requirement. ALSS is being used by Air Force Systems Command as a Research, Development, Test and Evaluation testbed.

(U) The development of the Joint Service Weapon Data Link (JSWDL), Project 2589, will provide a jam-resistant data link for tactical guided weapons by merging elements of the Air Force PLSS and Army Modular Integrated Communication Navigation System (MICNS).

RELATED ACTIVITIES: The GBU-15 modular glide weapons used with PLSS are developed under Program Element (PE) 64733F, Surface Defense Suppression. The portion of the JSWDL is being developed in conjunction with the Army's

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C3, #257

Title: Precision Location Strike Systems

Budget Activity: Tactical Programs, #4

Modular Integrated Communications Navigation System (MICNS) currently under full scale development. Advanced development work within PE 63727F, Advanced Communication Technology, has been structured to complement JSWDL and MICNS full scale development and provide improvements to the capability. An emitter identification effort has Army and Navy participation through sharing of technology equipment and test information. Demonstration of the Emitter Location System (ELS) capability is a joint Air Force/Army/Defense Advanced Research Project Agency (DARPA) effort associated with Battlefield Exploitation and Target Acquisition (BETA) under PE 27431F, Tactical Air Intelligence Systems. The airborne relay vehicles (TR-1) will be procured under PE 27215F, TR-1 Squadron.

(U) WORK PERFORMED BY: Overall management of all projects in this program element is by Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. See individual project descriptions on Precision Location Strike System (PLSS) and Advanced Location Strike System for details on specific contractors and participating organizations. The PLSS prime contractor is Lockheed Missiles and Space Company (LMSC), Sunnyvale, CA. The contractor for the command link, Distance Measuring Equipment (DME) link, and radio frequency (RF) modules is the PLSS DME subcontractor, Harris Corporation, Melbourne, FL. The JSWDL video modules will be developed under MICNS full scale development program, managed by the Army Electronics Research and Development Command (ERADCOM), Combat Surveillance and Target Acquisition Laboratory, Ft Monmouth, NJ. MIT Lincoln Laboratory, Lexington, MA, performs studies and provides consultative services. Technical cognizance of the Emitter Location System is performed by the Rome Air Development Center (RADC), Rome, NY with International Business Machines (IBM), Owego, NY, as the development contractor.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Precision Location Strike (PLSS) contractor, Lockheed Missiles and Space Company, was selected in June 1977. The Defense System Acquisition Review Council II (Development Readiness) review was held in July 1977 and the Deputy Secretary of Defense approved PLSS full scale development on 1 September 1977. System Requirements Review was held in January 1978. System Design Review was held in May 1978. Subcontractor Preliminary Design Reviews (PDRs) began in July 1978 to support subsystem PDRs beginning in November 1978. The system PDR was conducted satisfactorily in October 1979. Brassboard fabrication and testing aimed at risk reduction were also initiated. The first of four increments of the software Critical Design Review was completed in October 1980. An independent contractor for software validation and verification, SoftTech Corporation, was selected and began efforts to support the program. Discussions were conducted with North Atlantic Treaty Organization (NATO) allies on the combat potential of PLSS in NATO. Discussion on operational integration of PLSS into the NATO structure were also initiated.

(U) An emitter identification effort was initiated in 1973 with initial emphasis on feasibility demonstration of the technique. A large enough data base of emitters to give confidence in the technique under limited conditions was established in 1973-74. Three Advanced Identification signal processors were built in 1974 and became the brassboards for the Air Force testing of the technique. From 1975 to 1977 a large data base was collected to demonstrate feasibility under a wider range of conditions. This effort culminated in a flight test conducted during September 1978.

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems

Budget Activity: Tactical Programs, #4

(U) Since 1975, the Advanced Location Strike System (ALSS) has been utilized as a testbed to help define the PLSS baseline configuration, and in developing, evaluating, and refining operational concepts for a PLSS. Distance measuring equipment (DME) guidance for both guided and unguided ordnance delivery was demonstrated using a Pod Relay Subsystem on tactical aircraft. The Air Force and Army jointly succeeded in integrating the capabilities of moving target indicator radars with DME guidance techniques, and also demonstrated DME guidance by ALSS of surface-to-surface missiles. ALSS was utilized in the Red Flag and Blue Flag operational exercises and in successful demonstrations of DME guided GBU-15 Cruciform Wing and Planar Wing Weapons, with the latter demonstration completed in July 1979.

Project 1947, Emitter Location System (ELS) study efforts and follow-on demonstration programs show the ELS technique to be viable for precise location. The technique, proven by a Defense Advanced Research Projects Agency (DARPA) sponsored program, was integrated into the PLSS baseline design for Phase I of ELS/PLSS integration. Following completion of the ELS demonstrations in March 1978, ELS funds and equipment were applied to support the joint AF/Army/DARPA Coherent Emitter Location Testbed (CELT) development. CELT was transported to Europe in 1980 and participated in the REFORGER 1980 exercises during September and October 1980.

(U) Project 2106, Photogrammetric Target System (PTS), was initiated in 1974 with initial emphasis on a manual system for use with the Advanced Location Strike System, to be followed by a more automated system of greater capacity to be used throughout the Tactical Air Forces. Development of the manual system was cancelled in April 1975 with the Air Force procurement of the Army Analytical Point Positioning System. A service test model (STM) was procured for development of optical exploitation techniques and software for a PTS. A study of Tactical Air Force requirements began in September 1977 to resolve issues involving point positioning requirements.

(U) In July 1977, the Precision Location Strike System (PLSS) Defense Systems Acquisition Review Council (DSARC) II directed the Air Force to incorporate the Joint Service Weapon Data Link (JSWDL) into the PLSS development program. A JSWDL system analysis was initiated under the PLSS contract in September 1977 and completed in December 1977. A JSWDL development plan was approved in April 1978. The Air Force also incorporated JSWDL requirements into the Army's Modular Integrated Communication Navigation System (MICNS) program.

2. (U) FY 1981 Program: Design efforts and engineering tests will intensify, culminating in completed drawings and specifications for the system Critical Design Review. Precision Location Strike System (PLSS) subsystems will be fabricated. Qualification and acceptance testing of completed subunits will be initiated. Integration tasks relating to test and checkout of subsystems will also be continued. Software development is to be continued. Advanced Location Strike System (ALSS) will continue to support development testing associated with PLSS risk reduction as well as increasing knowledge of distance measuring equipment (DME) and time of arrival (TOA) techniques. ALSS will participate in joint Air Force/Army demonstrations.

3. (U) FY 1982 Planned Program: During this period the Critical Design Review (CDR) will be conducted. PLSS subsystem fabrication will continue.

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems
Budget Activity: Tactical Programs, #4

Qualification and acceptance testing of completed units will occur. Software development and independent software validation and verification will continue. Work previously deferred on peculiar support equipment development will be initiated. Integration of the full PLSS system will occur and system level testing will start. Advanced Location Strike System (ALSS) will continue to support development testing primarily in development of baseline data for PLSS test with potential use as range instrumentation during initial phases of PLSS Development Test and Engineering (DT&E). The FY 1981 estimate of FY 1982 requirements for the Program Element (PE) was \$60,800 thousand. The FY 1982 request of \$83,063 thousand increased the PE by \$12,263 thousand in order to purchase deferred hardware buys and to initiate deferred peculiar support equipment development. The increase was associated with the FY 1980 reduction and requires major schedule adjustments in all of the projects in the PE. Funding requirements for FY 1983 through completion are preliminary estimates pending schedule adjustments based on that reduction and the delays in getting additional funding in FY 1981. Total estimated cost of the PE increased by \$99,013 thousand to \$478,713 thousand primarily as a result of the shift of efforts into FY 1982 and beyond. Development of the Photogrammetric Target System, Project 2106, has been deferred until a statement of need is submitted and validated. Development of the Emitter Location System, Project 1947, and the Joint Service Weapon Data Link, Project 2589, as they apply to Precision Location Strike System (PLSS) requirements, are being carried as part of the PLSS, Project 1190, funds.

4. (U) FY 1983 Planned Program: Precision Location Strike System (PLSS) subcontractor unit fabrication and delivery will be completed for system integration, testing and checkout. Software development will be completed. Test aircraft modification will occur. Procurement of Development Test and Engineering/Initial Operational Test and Evaluation (DT&E/IOT&E) items will begin.

5. (U) Program to Completion: The combined DT&E/IOT&E for the PLSS will be completed followed by a Defense System Acquisition Review Council review for production. A positive production decision will be followed by initial deliveries beginning in late FY 1985.

6. Milestones:

	Date
A. Area Coordinating Paper Number 4	Mar 1972
B. Tactical Air Forces Required Operational Capability (TAF ROC) 314-74 Validated	Nov 1974
C. ALSS - Deployment to Europe	May 1975
D. PLSS Defense System Acquisition Review Council (DSARC) II/Milestone II	Jul 1977
E. ELS Feasibility Demonstration Complete	Mar 1978
F. Photogrammetric Targeting System (PTS) Studies Complete	Oct 1978
G. PLSS DSARC Review	TBD
H. CELT European Demonstration	Sep-Oct 1980
I. Initiate PLSS DT&E/IOT&E	Sep 1983
J. Complete DT&E/IOT&E - PLSS	Sep 1984
K. PLSS DSARC III/Milestone III	Nov 1984
L. PLSS Initial Operational Capability (1st production unit, 1st Unit Equipment squadron)	

* Data presented in FY 1981 Descriptive Summary.

Budget Activity: Tactical Programs, #4

Program Element: #64742F Precision Location Strike System

Test and Evaluation Data

1. Development Test and Evaluation: Tactical Air Forces Required Operational Capability No. 314-74, Location Strike System, 1 May 74, outlined the requirement for detection, identification, location, and strike of emitters. It also stated the requirement for a capability to strike radiating and non-radiating targets in all weather conditions.

Precision Location Strike System mission and description: The Precision Location Strike System will provide the tactical forces with an all-weather, standoff precision strike system capable of attacks against tactical targets (such as headquarters, command and control facilities, airfields, and bridges) located in the Precision Location Strike System electronic grid, while providing integrated near-real time detection, location and destruction of the enemy's defense system in a dense emitter and jammer environment. The Precision Location Strike System will be able to locate and destroy enemy and to operate in conjunction with other signal intelligence and reconnaissance systems to provide cueing and direct strikes for those systems. Electromagnetic emitter information collected by a triad of aircraft will be data linked to a ground Central Processing Subsystem for processing and evaluation. Potential target information will be forwarded to appropriate combat control elements which will direct tactical strike aircraft to the target area. The Central Processing System will provide steering and weapon release commands to the strike aircraft and, after weapon release, will control guided ordnance to the target. Unguided ordnance will be released so that the weapons' trajectories will carry them to the target. Possible follow-on applications include distance measuring equipment guidance of cruise weapons and missiles and the acquisition of targeting data for Army surface-to-surface missiles and artillery.

(U) Two contractors were reviewed through source selection process from September 1976 to June 1977 for Full-Scale Development. The contract was awarded to Lockheed Missiles and Space Company, Incorporated. A Defense System Acquisition Review Council II review, held on 26 July 1977, resulted in Deputy Secretary of Defense approval for Full Scale Development on 1 September 1977. Go ahead for Full Scale Development was given to Lockheed Missile and Space Corporation on 2 September 1977. Decision Coordinating Paper #129 schedule thresholds are as follows: (1) Preliminary Design Review complete, January 1979; (2) Critical Design Review complete, December 1979; (3) Start Development Test and Evaluation (Field Tests), June 1981; and (4) Complete Initial Operational Test and Evaluation, August 1982. The Preliminary Design Review and Critical Design Review thresholds has been breached and the others will be breached because of program stretches caused by funding reductions from the planned development program.

(U) Development Test and Evaluation accomplished to date consists of "breadboard" tests conducted by the prime contractor or his subcontractors to reduce the technical risks of developing Full Scale Development hardware.

Budget Activity: Tactical Programs, #4

Program Element: #64742F Precision Location Strike System

2. (U) Operational Test and Evaluation: The Precision Location Strike System initial operational test and evaluation scheduled to commence in August 1983 and be complete in February 1984 will be conducted at the United States Air Force Tactical Fighter Weapons Center Range Facility, Nellis Air Force Base, NV. This will allow use of the emitter environment on the Nellis and Naval Weapons Center (NWC), China Lake, CA ranges. Consideration is being given to conducting a portion of the Initial Operational Test and Evaluation in Europe. The full-scale development equipment to be evaluated is not expected to differ significantly from the production equipment.

(U) The Air Force Test and Evaluation Center will direct the Initial Operational Test and Evaluation portion of the combined Development Test and Evaluation/Initial Operational Test and Evaluation, using a team of fully trained Air Force operations and maintenance personnel and resources from Air Force Systems Command, Tactical Air Command, Air Force Logistics Command, and Air Training Command.

(U) The purpose of the Initial Operational Test and Evaluation phase will be to determine the operational effectiveness and suitability of the Precision Location Strike System when employed in its operational configuration. Initial Operational Test and Evaluation results will be used to input to the Defense System Acquisition Review Council III decision scheduled for 1984.

(U) Operational scenarios will be established to evaluate the ability of the system to identify and locate emitters, direct F-4 strike aircraft to deliver guided and unguided ordnance, and interface with command, control, and communications. The majority of the command, control, and communications interoperability evaluation is planned during the proposed European portion of the Initial Operational Test and Evaluation. The capability of the Precision Location Strike System to accurately track and control multiple weapon and delivery aircraft will be assessed. The survivability of the Airborne Vehicles, strike aircraft, and Precision Location Strike System ground components will be evaluated.

(U) An assessment of interoperability with other defense suppression systems, to include degradation from friendly electromagnetic interference, will be conducted. Degradation of location and strike accuracy, resulting from electronic countermeasures, will be evaluated. Evaluations of system reliability, maintainability, availability, and logistics supportability will also be conducted.

(U) Even though complete Precision Location Strike System support equipment will not be available until Fiscal Year 1984/1985, an acceptable evaluation of maintainability can still be completed. Approximately one-half of the Line Replaceable Units will be supportable by the support equipment available during Initial Operational Test and Evaluation. The remaining support equipment will be evaluated during follow-on operational test and evaluation.

Budget Activity: Tactical Programs, #4

Program Element: #64742F Precision Location Strike System

3. System Characteristics: The following are goals for critical parameters to be evaluated during Development Test and Evaluation/Initial Operational Test and Evaluation.

Parameter

Objectives

Demonstrated Performance

Probability of:
Location (1)

Identification (2)

Frequency Coverage

Range (3)

Accuracy (R/D=1) (4)

Strike

Location

System

Mission Reliability (5)

Mission Completion

Success Probability

1. Probability of location refers to the capability to locate emitters within the area of interest which radiate for a minimum time. Minimum times by class are:

Testing to be conducted in a benign electronic countermeasures environment.

2. (U) Probability of identification refers to the correct identification of those emitters located by the Precision Location Strike System.

3. (U) Range for operation of data link and distance measuring equipment is defined as the line-of-sight distance between Precision Location Strike System terminals; i.e., Central Processing Subsystem to Airborne Relay Vehicles, Airborne Relay Vehicle to Site Navigation Subsystems, and Airborne Relay Vehicle to Vehicle Navigation Subsystems and Weapon Navigation Subsystems. Range for emitter location is defined as the distance on the perpendicular bisector of the Airborne Relay Vehicle baseline measured from the baseline to the emitter of interest.

4. Range (R) is defined, for this parameter, as the distance on the perpendicular bisector of the Airborne Relay Vehicle baseline measured from the baseline (D) to the emitter/target of interest. For test purposes, these accuracy goals/thresholds are specified for a geometry of

5. (U) Mission reliability is the probability of mission success as defined in the Reliability Annex (Annex C to the Decision Coordinating Paper).

Project: 1190

Program Element: #64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Soviet/Warsaw Pact tactical doctrine emphasizes a 24-hour a day capability with a strong emphasis on protection of ground forces using air defense systems to reduce the effectiveness of airpower. Defense Intelligence Agency document, "Precision Location Strike System (PLSS) Electronics Warfare Threat Through 1990," June 1977, projects trends of
of Soviet systems.

Current and projected Air Force and Army systems will

All weather operations are constrained by accurate weapons with the lethal range of the enemy air defense systems. Current reconnaissance systems lack the ability to

threat.

Delivery of weapons is primarily from within capability while all

The development of the Precision Location Strike System (PLSS) will substantially alleviate any of the critical deficiencies in our all-weather tactical defense suppression close air support interdiction attack capabilities and will increase our reconnaissance capabilities. The Advanced Location Strike System (ALSS) is the predecessor system which supports continued development of operational concepts for a PLSS system by the Tactical Air Command and serves as a Research, Development, Test and Evaluation (RDT&E) testbed for PLSS risk reduction efforts.

(U) The PLSS project is a major program development effort. PLSS will provide targeting-accuracy, integrated location and strike of hostile air defenses continuously in near real time and all weather over a theater-wide area. As such, PLSS will be the centerpiece to efficient and effective conduct of lethal defense suppression to reduce attrition to acceptable levels, especially, in the critical first few days of conflict. Additionally, PLSS can provide up to the minute Electronic Order of Battle information enabling the commander to assess the immediate threat to his strike force.

The PLSS will provide a radar systems and a

circular error probable (CEP) location accuracy against air defense

The PLSS can update about

Once processed and identified, the system relays target information to the appropriate Air Force or Army battlefield commander,

Emitter target location is accomplished by using time-difference-of-arrival and direction-of-arrival techniques.

Identification of emitter type is accomplished from comparison with known parameters. New signals are used to update the electronic order of battle data. Further identification is being developed as

a part of the Precision Location Strike System (PLSS). The PLSS will be capable of operating in the dense emitter signal environment projected for Europe through 1990.

Project: 1190

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems (PLSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

Attacks on radiating and nonradiating targets will be with standoff guided weapons or with conventional ordnance using the PLSS Distance Measuring (DME) precision guidance. Use of DME guided standoff weapons significantly reduces the attrition of attacking forces from surface-to-air missile/anti-aircraft artillery (SAM/AAA) defenses. The PLSS will allow circular error probable (CEP) guidance accuracy giving a total system accuracy (location/strike) of less than

Using DME units on attacking aircraft will also reduce attrition through increased probability of target kill on the first pass. The PLSS can direct unguided ordnance delivery within an CEP of the target location. The DME guidance data link being developed will provide PLSS with high anti-jam protection to counter the Defense Intelligence Agency (DIA) projected threat environment.

(U) Full Scale Engineering Development of the PLSS was initiated in September 1977 after review by the Defense System Acquisition Review Council and approval by the Deputy Secretary of Defense. It is the USAF intent to request reprogramming authority to replace FY 1981 funds taken both in the amendment of the President's 1981 Budget and in the Congressional Appropriations Bill.

The Emitter Location System (ELS), Project 1947, was being developed to accurately locate for attack accuracy

The addition of ELS as an integrated subsystem of PLSS would give the Air Force the total capability for accurate location and all-weather attack of the full range of emitting enemy air defense systems. The ELS approach uses and has been pursued as a separate effort. The technology has rapidly advanced and the ELS capability can be integrated into PLSS through a phased approach to achieve location

The ELS technology has been validated and demonstrated in the Coherent Emitter Location Testbed (CELT). Other than the capability to locate which has been incorporated into the PLSS baseline, ELS has been deferred due to lack of funds.

The Advanced Location Strike System (ALSS), Project 1949, is the predecessor system to PLSS. The ALSS was designed to quickly deploy to Southeast Asia (SEA) in 1972 to locate and destroy sites. Those hostilities ceased before ALSS was deployed; however, it was deployed to Europe for operational test and evaluation. The known limitations (limited frequency coverage and weapons control, vulnerabilities to countermeasures, etc.) precluded introduction of ALSS into the operational inventory. Studies concluded that it was not cost-effective to modify ALSS to meet the PLSS requirement. ALSS is being used by Air Force Systems Command as a Research, Development, Test and Evaluation testbed.

(U) The development of the Joint Service Weapon Data Link (JSWDL), Project 2589, will provide a jam-resistant data link for tactical guided weapons by merging elements of the Air Force PLSS and Army Modular Integrated Communication Navigation System (MICNS).

Project: 1190

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems (PLSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: The GBU-15 modular glide weapons used with PLSS are developed under Program Element (PE) 64733F, Surface Defense Suppression. The anti-jam video portion of the JSWDL is being developed in conjunction with the Army's MICNS currently under full scale development. An emitter identification effort has Army and Navy participation through sharing of technology equipment and test information. Demonstration of the Emitter Location System (ELS) capability is a joint Air Force/Army/Defense Advanced Research Project Agency (DARPA) effort associated with Battlefield Exploitation and Target Acquisition (BETA) under PE 27431F, Tactical Air Intelligence Systems. The airborne relay vehicles (TR-1) will be procured under PE 27215F, TR-1 Squadron.

(U) WORK PERFORMED BY:

Development of Precision Location Strike System (PLSS) is managed by the Air Force System Command, Aeronautical System Division, Wright-Patterson AFB, OH. The prime contractor is the Lockheed Missiles and Space Company, Sunnyvale CA. Major subcontractors are: E-System, Garland, TX (intercept equipment and aircraft modification); Sperry Univac, Salt Lake City, UT (data link equipment); IBM, Owego, NY (strike and jammer location software and equipment); Collins, Dallas, TX (ground communications subsystems); Control Data Corporation, Minneapolis, MN (UYK-25 computers); Brunswick, Marion, VA (shelters); Harris Corporation, Melbourne, FL (navigation and strike data link), and Motorola Corporation, Phoenix, AZ (displays). MIT Lincoln Laboratory and Aerospace Corporation perform studies, analyses and related efforts in support of PLSS. Softech Corporation performs independent software verification and validation.

(U) PROGRAMS ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments:

The contractor, Lockheed Missiles and Space Company, was selected in June 1977. The Defense System Acquisition Review Council Milestone II (Development Readiness) review was held in July 1977 and the Deputy Secretary of Defense approved PLSS Full Scale Development on 1 September 1977. System Requirements Review was held in January 1978. System Design Review was held in May 1978. Subcontractor Preliminary Design Reviews (PDR) began in July 1978 in preparation for subsystem PDRs beginning in October 1978. Subsystem PDRs supported the system PDR held in October 1979. The first of four increments of the software Critical Design Review was completed in October 1980. Brassboard fabrication and testing for risk reduction was also initiated. An independent contractor for software validation and verification, Softech Corporation, was selected and began efforts to support the program. Discussions were conducted with North Atlantic Treaty Organization (NATO) allies on the combat potential of PLSS in NATO and on the operational integration of PLSS into the NATO structure. The Task Force 7, Electronic Warfare report as a part of the NATO Long Term Defense Program recommended the

2. (U) FY 1981 Program:

PLSS contractors will continue design efforts, engineering tests, and documentation culminating in completed drawings

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Project: 1190

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems (PLSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

and specifications for the system Critical Design Reviews (CDR). Software development will continue. Integration tasks relating to test and checkout of subsystems will continue.

3. (U) FY 1982 Planned Program:

During this period, the system CDR will be conducted. Subsystem elements fabrication will continue. Qualification and acceptance testing of completed units will occur. Integration tasks relating to test and checkout at the subsystem level will also continue. Integration of the full PLSS system will occur and system level testing will start. Work previously deferred on peculiar support equipment development will be initiated.

4. (U) FY 1983 Planned Program:

Precision Location Strike System subcontractor unit fabrication and delivery will be completed for system integration, testing and checkout. Software development will be completed. Test aircraft modification will occur. Procurement of Development Testing and Engineering/Initial Operational Test and Evaluation (DT&E/IOT&E) items will begin.

5. (U) Program to Completion:

Combined DT&E/IOT&E will continue and is scheduled to be completed in September 1984 followed by a Milestone III (production) review.

6. Milestones

	<u>Date</u>
A. TAF ROC 314-74 Validated	Nov 1974
B. Defense System Acquisition Review Council (DSARC) II/Milestone II	Jul 1977
C. Full Scale Development Contract	Sep 1977
D. Airborne Relay Vehicle Decision	Oct 1978
E. Preliminary Design Review	Oct 1979
F. DSARC Review	TBD
G. Critical Design Review	Dec 1981
H. Initiate DT&E/IOT&E	Sep 1983
I. Complete DT&E/IOT&E	Sep 1984
J. DSARC III/Milestone III	Nov 1984
K. PLSS Initial Operational Capability (first production unit, first Unit Equipment Squadron)	

* Date presented in FY 1981 Descriptive Summary.

Project: 1190

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Precision Location Strike Systems (PLSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

EXPLANATION OF MILESTONE CHANGES: See Section 8.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimate Costs</u>
RDT&E	12,100	14,750	82,500	77,100	102,700	428,150 ^{1/}
		^{1/} Includes \$0.4M for Coherent Emitter Location Testbed (CELT)				

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	11,800	61,900	60,200	-	55,300	327,900
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The FY 1981 estimate for the FY 1982 project requirement was \$60,200 thousand. The FY 1982 request of \$82,500 thousands is an increase of \$22,300 thousand due to rephasing and restructuring the program as a result of FY 1980 fiscal constraints and delay in getting additional funding in FY 1981. Funding requirements for FY 1981 through completion are preliminary estimates pending schedule adjustments based on the reduction.

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Project: 1949

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Advanced Location Strike System (ALSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Losses to Surface-to-Air Missiles (SAMS) early in 1972 during the Southeast Asian (SEA) conflict led to the establishment of a high priority, quick reaction program to suppress these SAMS. The Advanced Location Strike System (ALSS) was developed using technology developed under previous programs (COMPASS STRIKE, Time of Arrival Location System, Defense Suppression Task 04, Electronic Emitter Location System, etc.) to quickly deploy to SEA to locate and destroy sites. Due to the termination of hostilities, ALSS was never deployed to SEA. It was recognized that the ALSS would not satisfy Air Force requirements for the 1980s; however, ALSS was deployed to Europe in 1975 as a possible interim capability. Inherent design characteristics precluded introducing ALSS into the inventory and modifications to satisfy the operational requirement were not cost effective. The ALSS does not have the signal-sorting and data processing capability to handle the dense electromagnetic environment of Europe and is vulnerable to enemy countermeasures. The data links are especially vulnerable having The ALSS was returned to the Continental United States and located at Holloman AFB, NM. The ALSS has been used jointly as a development testbed by Air Force Systems Command and by the Tactical Air Command for operational exercises and for development of operational concepts for a Precision Location Strike System (PLSS).

The ALSS includes the following major elements: a master ground control station; ground Distance Measuring Equipment (DME) beacons for accurate location and positioning of airborne elements; airborne intercept receivers and relay equipment. Contractor maintenance support is used for the system.

(U) RELATED ACTIVITIES: Operational and Maintenance funds from Program Element (PE) 27244, Location Strike System, have been used to support the Air Force Systems Command Detachment operations.

(U) WORK PERFORMED BY: The ALSS project is managed by the Air Force Systems Command, Aeronautical Systems Division, Wright-Patterson AFB, OH. Contractor maintenance support is provided by IBM, Owego, NY.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The Advanced Location Strike System has been used extensively as a development testbed since 1975. Test results from ALSS were used to help define the baseline configuration for the Precision Location Strike System (PLSS). Data link vulnerability testing was accomplished and the concept for using a pod relay subsystem on tactical aircraft for Distance Measuring Equipment (DME) guidance of guided and unguided ordnance delivery was demonstrated. A joint effort with the Army was successfully completed which combined multilateration moving target indicator radars with DME guidance techniques. It demonstrated detection and tracking of ground moving targets for strike and the use of Distance Measuring Equipment (DME) guided standoff glide weapons for accurate attack against the moving targets. An FY 1977 joint effort with the Army demonstrated DME guidance by Advanced Location Strike System (ALSS) of surface-to-surface missiles. Modified Hawk Missiles were used at missile ranges of miles. Miss distances

Project: 1949

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Advanced Location Strike System (ALSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

ranged from

ALSS has been used by the Tactical Air Command in developing, evaluating, and refining operational concepts for a Precision Location Strike System (PLSS). ALSS has been used in both RED FLAG and BLUE FLAG operational exercises. ALSS supported DME guidance testing with the GBU-15 Planar Wing Weapon (PW). These tests assisted in defining the GBU-15 PW DME guidance parameters for inclusion into the Precision Location Strike System software routines and were completed in July 1979.

2. (U) FY 1981 Program: ALSS will continue to support development testing associated with PLSS risk reduction as well as increasing knowledge of distance measuring equipment (DME) and time of arrival (TOA) techniques.
3. (U) FY 1982 Planned Program: ALSS will continue to support development testing primarily in development of baseline data for PLSS test with potential use as range instrumentation during initial phases of PLSS Development Test and Engineering (DT&E).
4. (U) FY 1983 Planned Program: ALSS will continue support through DT&E and phase out in late FY 1983.

5. (U) Program to Completion: Not Applicable

6. (U) Milestones:

Start Development	Date
Development Testing	1971
Initial Operational tests	1972
Deployment to Europe (CONSTANT TREAT)	1973
GBU-15 Cruciform Wing Weapon Tests	May 1975
RED FLAG Exercise	Sep 1976
GBU-15 Planar Wing Weapon Tests	Sep 1977
RED FLAG Exercise	Sep 1978 and Jul 1979
Begin Phase Out	Sep and Nov 1978
Phase Out	Oct 1982
	1983

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Project: 1949

Program Element: # 64742F

DoD Mission Area: Electronic Warfare and Counter-C³, #257

Title: Advanced Location Strike System (ALSS)

Title: Precision Location Strike System

Budget Activity: Tactical Programs, #4

7. (U) Resources: (\$ in thousands)

	FY 1980 <u>Actual</u>	FY 1981 <u>Estimate</u>	FY 1982 <u>Estimate</u>	FY 1983 <u>Estimate</u>	Additional to Completion	Total Estimated Costs
RDT&E	700	100	600	600	0	39,400

8. (U) Comparison with FY 1981 Budget Data:

RDT&E*	700	700	600	-	600	39,800
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* For FY 1980 and beyond Project 1949 contains funds previously programmed in PE 35157F, Advanced Location Strike System.

(932)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64746F

DOD Mission Area: Defense Suppression, #224

Title: Expendable Drones
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
2942	TOTAL FOR PROGRAM ELEMENT	4,700	5,600	8,700	5,300	Continuing	Not Applicable
	Harassment Vehicle (LOCUST)	4,700	5,600	8,700	5,300	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The increasing costs of sophisticated defense suppression systems have caused the United States and North Atlantic Treaty Organization partners to exploit the unique capabilities provided by large numbers of low cost, expendable, simple, unmanned systems to effectively suppress the expanding enemy air defense radar threat. This Program Element provides the United States share of funding for the joint development of an anti-radar defense suppression mini-drone with the Federal Republic of Germany. This system, referred to as LOCUST, is required by the United States and German Air Forces to augment other defense suppression resources. This requirement has been endorsed strongly by the commanders of Tactical Air Command, Pacific Air Forces and United States Air Force Europe,

(U) BASIS FOR FY 1982 RDT&E REQUEST: The LOCUST vehicle program was initiated in FY 1979 with competitive United States contract awards for a low-cost anti-radar seeker. The anti-radar seeker became a part of the Joint LOCUST vehicle program after the Memorandum of Agreement was signed. The United States Air Force and the German Federal Ministry of Defense Memorandum of Agreement provides for the joint development of the LOCUST vehicle, including integration of the anti-radar seeker. This request provides for United States FY 1982 share of the joint development program and the development of an anti-communications jammer seeker as a United States only effort. The cost estimates were derived in March 1980 by the Systems Program Office using analogy and parametric cost estimating models with cost data and descriptors.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	4,700	5,600	4,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (Missile) (Program Element # 27246F)

(Quantity)

Military Construction

Operation and Maintenance

28,100	367,300	395,400
(220)	(6720)	(6940)
212	107	319
127	Continuing	Not Applicable

CLASSIFIED BY: ASD-63 HWS SCG February 1979
DECLASSIFY ON: 1 December 1998

Project: #2942

Program Element: #64746F

DOD Mission Area: Defense Suppression, #224

Title: Harassment Vehicle (LOCUST)

Title: Expendable Drones

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The purpose of the LOCUST vehicle development program is to provide a low-cost, expendable system which can provide a persistent threat to damage and defeat enemy air defense radar systems. This weapon system is needed to augment other United States and German Air Force electronic warfare defense suppression systems required to counter increased quantities, sophistication and concentration of enemy air defense radars. The most important aspect of the LOCUST vehicle concept is to use large numbers of low-cost expendable mini-drones to complement more expensive systems. These drones will be ground-launched and programmed to fly where enemy radars are known to be operating. Once in the target area, the LOCUST vehicles will establish a loiter pattern, waiting for enemy radars to begin transmitting. Each vehicle will

After launch, the drones operate autonomously requiring no data link for command and control. Because of its size, characteristics, and profile, it will not be vulnerable to most anti-aircraft systems. Prior to preparation for launch, LOCUST vehicles will be maintained in storage similar to conventional munitions. When required, they will be transported to the launch area in storage containers where they will be quickly fueled, checked, programmed, and launched. The key to the LOCUST vehicle concept is to acquire a sufficient level of capability at a low cost. A unit design-to-cost goal of \$14,000 has been established for a full up (fly-away) system. Funds will be requested to support initial production in FY 1983. Sufficient tests and analysis have been performed during a United States Air Force/German Air Force feasibility demonstration to provide confidence that the LOCUST vehicle will perform its mission efficiently and effectively.

(U) RELATED ACTIVITIES: The LOCUST vehicle is an outgrowth of a Defense Advanced Research Project Agency mini-drone demonstration program. Advanced development of mini-drone technology, applicable to LOCUST vehicle requirements, is being performed in Program Element 63739F, Advanced Drone/Remotely Piloted Vehicle Development. The Army (Program Element 62732A, Remotely Piloted Vehicle Support Technology; Program Element 63725A, Remotely Piloted Vehicles/Drones and Program Element 64730A, Remotely Piloted Vehicle) has drone programs directed toward reconnaissance and surveillance which may be applicable to future mini-drone missions. Coordination of these efforts is maintained through the Joint Technical Coordinating Group under the Joint Logistics Commanders and the Office of the Secretary of Defense. Federal Republic of Germany participation in LOCUST vehicle feasibility demonstration testing has been through a Memorandum of Agreement. A new Memorandum of Agreement has been negotiated which formalizes German participation in full-scale development. Procurement of the LOCUST system will be accomplished in Program Element 27246F, Expendable Drones, at the completion of full scale development.

(U) WORK PERFORMED BY: The Aeronautical Systems Division of the Air Force Systems Command at Wright-Patterson Air Force Base, OH, is the government agency responsible for this Program Element. Competitive contracts for development of the anti-radar seekers were awarded to General Dynamics, Pomona, CA and Texas Instruments, Dallas TX. Bidders for the LOCUST full scale engineering development, to include integration of the anti-radar seekers, are: Teledyne Ryan Aeronautical, San Diego, CA; Texas Instruments, Dallas, TX; and General Dynamics, Pomona, CA. Each United States

Project: #2942

Program Element: #64746F

DOD Mission Area: Defense Suppression, #224

Title: Harassment Vehicle (LOCUST)

Title: Expendable Drones

Budget Activity: Tactical Programs, #4

industry bidding on the LOCUST program is teamed with a lead German subcontractor. The German subcontractors include Messerschmitt-Bloelkow-Blohm, Muenchen, West Germany; Vereinigte Flugtechnische Werke Fokker, Bremen West Germany; and Dornier, Friedrichshafen, West Germany.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: An existing mini-drone was configured with a passive sensor and logic system to demonstrate feasibility (the essential elements) of an autonomous system to attack enemy radars. Initial LOCUST Vehicle flight testing was conducted at Nellis Air Force Base, NV. Testing of United States and German candidate warheads was conducted at Eglin Air Force Base, FL. Final flight demonstration testing was completed at Meppen, Germany in March 1977. The results of the actual tests, computer simulations, and analyses indicate the warhead has a percent probability of disabling an radar if the LOCUST Vehicle impacts within of the system. The actual flight tests and simulations show the expected impact accuracy of the LOCUST Vehicle is less than

The requirement and concept of employment for the LOCUST Vehicle was expanded and updated in October 1976. The requirement represents the Joint United States/German Air Forces' needs for this system. Because of Congressional funding limitations in FY 1978, United States activity on the LOCUST Vehicle was limited to concept definition studies which were conducted through forward financing of remaining FY 1977 funds. Parallel United States and German efforts continued in FY 1978 in preparation for beginning joint full-scale development in FY 1979. United States definition efforts included: requirements and effectiveness studies, vulnerability modeling of target radar systems, warhead optimization, effectiveness analysis with other defense suppression systems, seeker system optimization, fueling and storage concepts. Program instability during the FY 1979 budget process delayed preparation of the joint Program Memorandum of Agreement with Germany. In order to accelerate the system acquisition, the program plan was revised to initiate United States development of a low-cost anti-radar seeker while Memorandum of Agreement negotiations/coordination continued. Dual competitive anti-radar seeker contracts were awarded in June 1979. The Office of Secretary of Defense, State Department, and Office of Management and Budget provided the Air Force authorization in September 1979 to conclude final negotiations of the Memorandum of Agreement with the German Federal Ministry of Defense. The Memorandum of Agreement was signed and executed by both governments effective 23 March 1980. Requests for proposals were released to United States and German industries on 1 May 1980.

2. (U) FY 1981 Program: Contracts for joint development of the LOCUST vehicle airframe, warhead, navigation system and flight controls, launcher and integration of the anti-radar seeker will be awarded. The United States and German industries will share in these development efforts in accordance with the Memorandum of Agreement. A Memorandum of Agreement will be prepared with the German Federal Ministry of Defense for joint production of the LOCUST vehicle. Memorandum of Agreement negotiations with Germany for LOCUST production program will begin. Competitive development of the anti-radar seeker will continue.

Project: #2942

Program Element: #64746F

DOD Mission Area: Defense Suppression, #224

Title: Harassment Vehicle (LOCUST)

Title: Expendable Drones

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Program: Joint development of LOCUST will continue. Full scale engineering development of an anti-communication jammer seeker will begin as a United States only effort. The seeker will be integrated into the LOCUST or other complementary expendable mini-drone airframe.

4. (U) FY 1983 Planned Program: Planned efforts include completion of LOCUST Development Test and Evaluation and the initiation of Operational Test and Evaluation necessary to allow a production decision. The Memorandum of Agreement with the German Federal Ministry of Defense for joint production of the LOCUST Vehicle will be concluded. Long-lead tooling procurement and initial LOCUST procurement will begin. Development of the anti-communications jammer seeker will continue.

5. (U) Program to Completion: Production of the LOCUST Vehicle in sufficient quantities of low-cost expendable mini air vehicles to support United States and German air defense suppression needs will continue. LOCUST Vehicle system improvements will be incorporated as required by developing and integrating advanced technology systems in response to revised threat and mission needs.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
RDTE	4,700	5,600	8,700	5,300	Continuing 367,300	Not Applicable 395,400
Procurement (Missile)(Program Element # 27246F)				28,100		

8. (U) Comparison with FY 1981 Budget Data:

	<u>4,700</u>	<u>5,700</u>	<u>4,000</u>	<u>Continuing</u>	<u>Not Applicable</u>
RDTE					

(U) FY 1982: Funds reflect an increase of \$2,400 thousand due to a repricing of the LOCUST program after industry comments to a draft Request for Proposal were taken into consideration. An additional \$2,300 thousand was added to the FY 1982 estimate for initiating the development of an anti-communications jammer seeker.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64750F

DoD Mission Area: Tactical Air Reconnaissance #255

Title: Intelligence Equipment
Budget Activity: Tactical Programs #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
1174	TOTAL FOR PROGRAM ELEMENT	19,800	15,700	15,100	14,900	Continuing	Not Applicable
1955	Intelligence Security Equipment	1,177	900	3,000	2,700	Continuing	Not Applicable
2053	Air Force Indications & Warning	7,623	7,800	6,700	7,300	Continuing	Not Applicable
2165	Foreign Technology Division	3,896	4,500	3,500	4,300	Continuing	Not Applicable
2323	Intelligence Processes	3,311	1,000	700			20,400
2631	COMPASS PREVIEW	2,793	1,200	100			5,500
2711	Radar Prediction System		300	1,100	600	Continuing	Not Applicable
	Computer Assisted Mission Planning System						
	Tactical SIGINT	1,000					

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This Program Element supports United States Air Force operating commands by performing the engineering development of ground equipment used to process, integrate, display and distribute intelligence data. This equipment will reduce the time required for the exploitation of intelligence data to meet the needs of Air Force agencies producing strategic, tactical, and scientific and technical intelligence. The equipment will also improve the efficiency of those units producing air target materials and those engaged in countering the foreign intelligence threat to the Air Force mission.

(U) BASIS FOR FY 1982 RDT&E REQUEST: These funds are requested to continue development efforts to improve the timeliness and accuracy of intelligence products provided to the operational commanders, the research and development planners, and the National Command Authorities. FY 1982 funds will improve capabilities to: (1) produce a warning of foreign threats, (2) evaluate foreign weapons systems, (3) exploit digital imagery, (4) produce radar predictions, and (5) perform tactical unit mission planning. Funds will also be used to develop equipment to assist in countering the foreign surveillance threat and improve the collection of foreign intelligence using human resources. The cost estimates for this program were developed by the Air Force Systems Command program offices.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	18,300	16,600	13,000		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: None.

Program Element: #64750F

DoD Mission Area: Tactical Air Reconnaissance #255

Title: Intelligence Equipment

Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objectives are to develop hardware and software for the exploitation of data, and the production of target materials to improve existing capabilities presently being employed by various operating commands. Also, equipment and techniques will be developed to support units involved in countering the enemy surveillance threat to the Air Force mission, and to assist in the collection of foreign intelligence through the use of human resources. The program objectives are accomplished through the following projects:

- 1174 (U) Intelligence Security Equipment - Develops equipment and techniques to counter foreign surveillance threats. The project also develops unique equipment and techniques to support the Air Force mission for collection of foreign intelligence through the use of human resources and to support the intelligence aspects of prisoner of war escape and evasion.
- 1955 Air Force Indications and Warning - Improves the existing capability by modernizing the Air Force Indications and Warning Centers at Strategic Air Command, Aerospace Defense Command, Military Airlift Command, and Alaskan Air Command to provide compatibility with the National Military Intelligence Center modernization effort. Provides a capability to rapidly correlate available all-source intelligence data, and develop indications and warning of threats to assist the National Command Authorities and military commanders in managing a crisis situation.
- 2053 (U) Foreign Technology Division Intelligence Processes - Improves the Foreign Technology Division capability to acquire, evaluate, analyze, and report on foreign scientific and technical information and material. These improvements will assist in responding to intelligence requirements vital to the operational commanders, research and development planners, and national level agencies.
- 2165 (U) COMPASS PREVIEW - Develops a test-bed digital imagery exploitation device for Air Force softcopy conceptual validation testing.
- 2323 (U) Radar Prediction System - Develops and implements an automated system that will produce a prediction of a radar scope display of specific geographic areas. This radar prediction is generated from a digital data base and primarily supports the aircraft crew members in mission planning for strike and reconnaissance (F-16, B-52, F-111, F/RP-4), or air drop delivery (C-130).
- 2631 (U) Computer Assisted Mission Planning System - Develops a capability to provide timely aircrew mission planning. This project will develop an automated capability to assist in route planning, compute required fuel loads, perform penetration analysis to best avoid enemy defenses, and accomplish weapons planning.

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Program Element: #64750F

DoD Mission Area: Tactical Air Reconnaissance #255

Title: Intelligence Equipment

Budget Activity: Tactical Programs #4

RELATED ACTIVITIES: Intelligence program activities of joint service interest such as the Indications and Warning efforts are coordinated with the Defense Intelligence Agency. Exploratory and advanced development activities related to this program are conducted under Program Element 62702F, Command Control and Communications and 63789F, Command, Control, and Communications Advanced Development. Other related Air Force Activities include Program Elements 31011G(F), Cryptologic Activities; 31328F, Strategic Air Command; 31310F, Foreign Technology Division; 31334F, Air Force Other Commands; 31335F, Air Force Automated Data Processing Support to General Defense Intelligence Program; 31318F, HUMINT (Controlled); 31321F, HUMINT (Overt); 35127F, Foreign Counterintelligence; 35128F, Security and Investigative Activities; and 27431F, Tactical Air Intelligence System Activities.

WORK PERFORMED BY: The Air Force manager is the Rome Air Development Center, Griffiss AFB, NY. Major contractors are Planning Research Corporation, McLean, VA; INCO Incorporated, McLean, VA; BETAC Corporation, Burlington, MA; General Electric Company, Daytona Beach, FL; Northrop Corporation, Hawthorne, CA; Computer Science Corporation, Falls Church, VA; GTE Sylvia, Mountain View, CA; International Computing Company, Bethesda, MD; Pattern Analysis and Recognition Corporation, Rome, NY; and Roaz-Allen and Hamilton, Bethesda, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

Project 1174 - The Intelligence Security Equipment Project normally has 10-12 independent tasks on-going simultaneously. Examples of Fiscal Year 1980 and prior accomplishments are: design and fabrication of a

for field testing; functional design of a countermeasures receiver; development of a range-gated television system for surveillance in adverse light and weather conditions; development of a secure data/speech recording system; and started design and fabrication of a processor to automatically enhance audio recordings degraded by noise.

(U) Project 2053 - Completed definition of missile forecasting methodology; initiated effort to define and test a methodology to forecast foreign space system capabilities; initiated effort to develop an analytical method for determining and quantifying maneuverable reentry vehicle capabilities; initiated efforts to develop computer models of liquid and solid propellant rocket engines to correlate with telemetry data; initiated effort to develop a computer performance measures capability to improve management of all internal Foreign Technology Division data processing resources; and initiated effort to refine and analyze requirements, and provide specifications supporting the Information Support System, an upgrade to the Foreign Technology Division's data processing environment.

Project 2165 - Detailed system specifications were developed in Fiscal Year 1975. Fabricated a COMPASS PREVIEW functional mock-up for in-depth test and evaluation of the test bed design. Fabrication began in late Fiscal Year 1976 and was completed in Fiscal Year 1980. The system was installed at Headquarters Strategic Air Command and interfaced with the

Program Element: #64750P

DOD Mission Area: Tactical Air Reconnaissance #255

Title: Intelligence Equipment

Budget Activity: Tactical Programs #4

- (U) Project 2323 - Completed validation phase and began full scale development of the Radar Prediction System.
- (U) Project 2631 - Not applicable.
- (U) See Separate Descriptive Summary for Project 1955.

2. (U) FY 1981 Planned Program:

Project 1174 - Work will continue on a number of tasks including: evaluating techniques for improving and automating the processes involved in the preparation of design and fabrication of a computerized audio processor; design evaluation of a covert mobile communication antenna; and design of a miniature addressable transceiver system.

- (U) Project 2053 - The initiatives started in Fiscal Year 1980 to improve total foreign threat analysis methodologies will be continued. Foreign Technology Division systems integration effort including the computer performance measures effort and support to the Information Support System upgrade will also continue. New starts include the major prototype activities in support of the Information Support System. Other new efforts include: requirements definition and development of functional descriptions and specifications for an upgrade to missile guidance subsystems methodologies; integration of the electro-optical data base with the electromagnetic warfare system; and development of instrumentation for measuring the effects of atmospheric aerosols on laser beams.

- (U) Project 2165 - Conduct operational testing of COMPASS PREVIEW test-bed. Image interpreters from Strategic Air Command, Tactical Air Command, United States Air Forces in Europe, Pacific Air Forces, and Foreign Technology Division will participate in the test program.

- (U) Project 2323 - Complete development and conduct developmental and operational testing of Radar Prediction System.

- (U) Project 2631 - Initiate development of prototype computer assisted mission planning system for the tactical units.

- (U) See Separate Descriptive Summary for Project 1955.

3. (U) FY 1982 Planned Program:

Project 1174 - Continue efforts on-going in Fiscal Year 1981. The Fiscal Year 1982 request is \$2.0 million dollars more than estimated in the Fiscal Year 1981 Descriptive Summary. The increase is primarily attributable to a new effort in Project 1174 to develop a

Program Element: #64750F

DoD Mission Area: Tactical Air Reconnaissance #255

Title: Intelligence Equipment

Budget Activity: Tactical Programs #4

- (U) Project 2053 - Complete development of maneuverable reentry vehicle analysis capability; complete initial phase of computer performance measures development; continue Information Support System prototype effort; complete liquid engine rocket modeling effort; continue implementation of a missile forecasting capability; and continue architectural design and analysis of Information Support System.
- (U) Project 2165 - Complete COMPASS PREVIEW testing,
- (U) Project 2323 - Complete Radar Prediction System testing.
- (U) Project 2631 - Continue development and begin testing of prototype computer assisted mission planning system.
- (U) See Separate Descriptive Summary for Project 1955.
4. (U) FY 1983 Planned Program:
- Project 1174 - Complete development of countersurveillance and human resources intelligence collection development efforts. Continue other
- (U) Project 2053 - Implement computer performance measures capability based on specifications delivered in Fiscal Year 1982; complete Information Support System prototype effort; complete implementation of a missile forecasting capability. New starts will begin to improve other areas of weapon systems analysis.
- (U) Project 2165 - Not applicable.
- (U) Project 2323 - Not applicable.
- (U) Project 2631 - Complete testing of initial computer assisted mission planning capability. Continue software development of additional required capabilities.
- (U) See Separate Descriptive Summary for Project 1955.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.
7. (U) Resources: Not applicable.

Project: #1955

Program Element: #64750F

DOD Mission Area: Tactical Air Reconnaissance #255

Title: Air Force Indications and Warning

Title: Intelligence Equipment

Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: This project provides for the implementation of improved indications and warning capabilities at Air Force Indications and Warning Centers/Facilities. Improvements are directly related to the Defense Intelligence Agency modernization program for the National Military Intelligence Center. Improvements are necessary to allow interconnecting of computers between the Air Force Indications and Warning Centers/Facilities and the National Military Intelligence Center. The objectives of this project are to: provide for the rapid and reliable analysis of indications and warning intelligence, provide assessments of the indications and warning intelligence and the resulting implications concerning national interest, and provide the National Command Authorities and military commanders with timely and accurate assessments to assist in determining a national course of action. New technologies have evolved that permit rapid analysis of multi-source data and remote access to other intelligence data bases to assure the use of all available information to postulate an indication of future events. These technologies will be incorporated into Indications and Warning Centers/Facilities to permit rapid assessment and reporting.

(U) RELATED ACTIVITIES: Intelligence program activities of joint service interest are coordinated with the Defense Intelligence Agency. Implementation activity is conducted under Program Elements 31328F, Strategic Air Command; 31334F, Air Force Other Commands; and 31335F, Air Force Automated Data Processing Support to General Defense Intelligence Program. Exploratory development activities related to this project are conducted under Program Element 62702F, Command Control and Communications.

(U) WORK PERFORMED BY: The Air Force manager is Rome Air Development Center, Griffiss AFB, NY. Major contractors are Planning Research Corporation, McLean, VA; INCO Incorporated, McLean, VA; BETAC Corporation, Burlington, MA; Pattern Analysis and Recognition Corporation, Rome, NY; and Booz-Allen and Hamilton, Bethesda, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The development activities through Fiscal Year 1980 have centered on major improvements at Strategic Air Command and Aerospace Defense Command. The major thrust was providing a capability to manage intelligence information internal to the commands' indications and warning functions. Efforts supporting the Strategic Air Command Operational Intelligence Support System provide automated intelligence information dissemination, analyst information exchange, and intelligence product generation. The Aerospace Defense Command development has focused on existing sensor system exploitation and long-range space defense intelligence functions. The primary products have been software oriented systems to assist analysts information correlation and improve the accuracy and timeliness of information exploitation.
2. (U) FY 1981 Planned Program: Expansion of the Strategic Air Command Operational Intelligence Support system to provide external analyst access to national level files is planned. This includes data at the Defense Intelligence Agency and National Security Agency to improve signals intelligence and electronic intelligence exploitation for trend analysis. Implementation of graphics and pattern recognition concepts will be started. The Aerospace Defense Command development will continue the initial implementation and specification of an intelligence space defense indications and warning capability. The requirement for a total hardware/software system will be analyzed. Efforts to upgrade the indications and warning capabilities of the Military Airlift Command and Alaskan Air Command will be started.

Project: #1955

Program Element: #64/50F

DoD Mission Area: Tactical Air Reconnaissance #255

Title: Air Force Indications and Warning

Title: Intelligence Equipment

Title: Intelligence Equipment

3. (U) FY 1982 Planned Program: The Strategic Air Command Operational Intelligence Support System graphics and trend analysis capability will become operational. Data base requirements and indicator requirements at Strategic Air Command will be addressed. The Aerospace Defense Command effort includes implementation of an improved space history missile data base along with unique space and missile indicators. The Alaskan Air Command effort includes an initial stand-alone correlation and analysis capability. The Military Airlift Command effort will expand the information dissemination capabilities transferred from Strategic Air Command to provide data base and unique indicator support.

4. (U) FY 1983 Planned Program: Continue Strategic Air Command, Aerospace Defense Command, Military Airlift Command, and Alaskan Air Command indications and warning modernization efforts. The project will address inadequacies in the following general areas: analyst decision support algorithms, improved message retrieval and correlation, graphical display and portrayal of information for summarization and trend analysis, event driven processing using real time sensor inputs, improved reliability and increased throughput of automated data processing resources, and improved data base support capabilities.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
					Costs	Costs
RDT&E	7,623	7,800	6,700	7,300	Continuing	Not Applicable
<u>Comparison with FY 1981 Budget Data:</u>						
RDT&E	7,200	7,900	6,700		Continuing	Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64751F

DOD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Intra-Theater Imagery Transmission System (IITS)
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
2387	TOTAL FOR PROGRAM ELEMENT Intra-Theater Imagery Transmission System	1,000 1,000	2180 2180	500 500	0 0	0 0	5382 5382

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Intra-theater Imagery Transmission System program will develop a system to electrically transceive high priority reconnaissance imagery (pre-analyzed and annotated by photo interpreters) to commanders, mission planners and strike crews. Presently, imagery support to the close air support and interdiction missions is provided by courier methods, which are too slow for time-sensitive targets. Timely imagery support via Intra-theater Imagery Transmission System will enhance ordnance and tactics selection, as well as target orientation for strike crews. Intra-theater Imagery Transmission System will use existing and planned, fixed and tactical communications as the transsion medium.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Provides funds to develop integration designs and plans for the 160 units of Production Intra-theater Imagery Transmission System Equipment; and to support turnover of the prototype terminals to United States Air Forces in Europe for an Interim Operational Capability. The cost estimate was developed by the Air Force Systems Command program office with assistance from the MITRE Corporation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	200	2,200	500		0	4,602
Procurement: None						0
(U) <u>OTHER APPROPRIATION FUNDS:</u>						
Procurement (Other) (PE 27431F)	0	0	2,956	2,934	13,417	19,300
(Quantity)			(29)	(27)	(104)	(160)

945
945
862

Project: #2387

Program Element: #64751P

DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: Intra-Theater Imagery Transmission System (IITS)

Title: Intra-Theater Imagery Transmission System (IITS)

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Intra-theater Imagery Transmission System will be a secure ground-based dissemination system which will provide the capability to the users to transceive high priority reconnaissance imagery needed for effective command and execution of theater warfare. The system will be fielded to the United States Air Forces in Europe and Pacific Air Forces commands and for deployment with Tactical Air Command, and Tactical Air Force Reserve, and Air National Guard units. The system will accept intelligence products (pre-analyzed and annotated by interpreters), such as photo, infrared, radar and side looking airborne radar imagery and distribute these to users in the theater. It is planned to operate over the automatic voice network during the Initial Operational Test and Evaluation and over Automatic Digital network and Tactical Communications when the production models are fielded, and eventually over the higher quality communications planned for the 1980's. The goal is to transmit a 9" x 9" image that has 16 shades of gray and 200 lines/inch resolution in under ten minutes. The inadequacy of current courier deliveries forces the theater commanders, mission planners and strike crews to rely upon incomplete or obsolete information to perform their jobs. In order to optimize interoperability and equipment commonality, the Intra-theater Imagery Transmission System will use the Tactical Digital Facsimile transceiver being developed by the Navy under Program Element 28010N, project XO 723-CC, through the Joint Tactical Communications Program Office. This transceiver will be integrated with communications security and interface devices to permit operation over existing tactical communications.

(U) RELATED ACTIVITIES: This system will be capable of transmitting imagery from existing and planned in-theater and worldwide sources. It will be capable of providing imagery to the other services. The system requirements have been reviewed by the other services to eliminate duplication of effort and to insure the ability to share imagery. The production units will be purchased under Program Element 27431P, Tactical Air Intelligence System Activities, FY 1982-1984, estimated at \$19.3 million. Air Force Communications Command will provide communications interface engineering and installation.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom Air Force Base, MA is responsible for program management. MITRE Corporation, Burlington, MA is providing technical support. Datalog Corporation, Melville, NY is the development contractor for the Joint Tactical Communications Program's Tactical Digital Facsimile transceiver.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A study of the imagery dissemination requirements of all services was completed in 1975. The full scale engineering development program for the Intra-theater Imagery Transmission System was cancelled by the Air Force in May 1978 in favor of using the Joint Tactical Communications Program's Tactical Digital Facsimile transceiver to form the basis for an Intra-theater Imagery Transmission System. Funds were transferred to the Navy to purchase eight Tactical Digital Facsimile terminals to be used for Intra-theater Imagery Transmission System integration and testing. Designed interface equipment assemblies to integrate Tactical Digital Facsimile transceiver, modems and encryption equipment into a prototype Intra-theater Imagery Transmission System. Began planning for the Air Force European testing of Intra-theater Imagery Transmission System.

Project: #2387

Program Element: #64751P

DOD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Intra-Theater Imagery Transmission System (IITS)
Title: Intra-Theater Imagery Transmission System (IITS)
Budget Activity: Tactical Programs, #4

2. (U) FY 1981 Program: Accept delivery of the prototype Intra-theater Imagery Transmission System assemblies and perform a system Initial Operational Test and Evaluation to evaluate the communications interfaces and network performance including interoperability with tactical communication and host country communication media and to test the Tactical Air Forces' operational scenarios, evaluating the performance of the Intra-theater Imagery Transmission System under real operational conditions in the tactical environment United States Air Forces Europe.
3. (U) FY 1982 Planned Program: Will turnover the eight prototype transceivers to United States Air Forces Europe to use as an interim intra-theater imagery transmission system. Will develop integration design and plans for fielding 160 production transceivers to the Tactical Air Forces. Will order the first increment of transceivers. The cost difference between FY 1981 and FY 1982 Descriptive Summaries reflects inflation and the addition of procurement (Other) funds during the FY 1982 Program Objective Memorandum Cycle to buy the IITS transceivers in FY 1982.
4. (U) FY 1983 Planned Program: Order second increment of transceivers (3080 funds).
5. (U) Program to Completion: Receive first production transceivers in FY 1984. The cost difference between FY 1981 and FY 1982 Descriptive Summaries reflects (1) the addition of procurement (other) funds during the FY 1982 Program Objective Memorandum Cycle to buy the transceivers. Originally, funding was programmed to begin in FY 1981 but delays in the Tactical Digital Facsimile program caused Air Staff to delete funding until Navy could establish a revised delivery schedule. (2) the increase in RDT&E funding is compensation for inflation rate changes. RDT&E is planned to be complete in FY 1982. Procurement of the transceivers will continue through FY 1986 with final delivery in FY 1987 or 1988.
6. (U) Milestones: Not Applicable.
7. (U) Resources: Not Applicable. Single project program.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64753F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Combat Helicopter Modernization
Budget Activity: Tactical Programs, #4

(U) RESOURCES (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
				19,300	33,900	29,400	82,600

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Modernization of the Aerospace Rescue and Recovery Service and the Special Operations Force must begin at once to replace obsolescent, hard-to-maintain equipment and to upgrade helicopter capabilities to cope with increasing threats. The objective of this program is to develop a derivative of the Army UH-60A Black Hawk helicopter to meet Air Force combat rescue and special operations mission requirements. Improved avionics, auxiliary fuel tanks, air refueling capability, and necessary mission equipment will be integrated into the H-60, a helicopter with proven performance, reliability, maintainability, and combat/crash survivability. A version of the Navy SH-60B Seahawk engine will be used to provide the added performance needed due to the increased air vehicle weight and the more demanding Air Force missions. The off-the-shelf avionics suite will enhance mission responsiveness and force survivability by providing a capability for precision low level navigation at night or in adverse weather. Commonality of systems/subsystems with Army and Navy versions of the H-60 will be maintained to the maximum extent consistent with Air Force operational requirements and concepts.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The low-risk combination of proven airframe and engines coupled with off-the-shelf avionics equipment will allow a Full-Scale Development decision in early FY 1982. The FY 1982 RDT&E request includes funds to accomplish engineering design, order two test sets of avionics equipment, and initiate software program development. Two production Black Hawk airframes will begin modification to test and evaluation configuration. Aeronautical Systems Division cost estimates for the airframe and for off-the-shelf avionics equipment were derived from actual data whenever available. Systems development and integration cost estimates were based on data from similar programs.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E Procurement	Not applicable					

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft)
Program Element # 35113F
Program Element # 27241F

To be determined
To be determined

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Program Element: #64753F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Combat Helicopter Modernization

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION:

1. (U) Modernization of the Aerospace Rescue and Recovery Service and the Special Operations Force must begin at once to replace obsolescent, hard-to-maintain equipment and to upgrade helicopter capabilities to cope with increasing threats. The current Air Force combat rescue/special operations force is limited in numbers and capabilities, and some of the systems in the inventory are reaching the end of their useful service lives. In particular, the H-3 -- which represents about half the current combat rescue/special operations helicopter inventory -- is an obsolescent, marginally capable system, and it must be replaced beginning in the mid-1980s. In the Southeast Asia conflict, normal search and rescue missions required that the H-3 be operated above design gross weight, which prevented normal hovering takeoffs and often required that fuel be dumped prior to recovery operations. The H-3 force has become increasingly inefficient to operate and difficult to maintain. Replacing H-3s with H-53s is not an affordable solution and will not provide the reliability and maintainability needed for dispersed, forward area combat rescue/specialized mission operations.

2. (U) The objective of this program is to develop and procure a derivative of the Army UH-60A Black Hawk helicopter to meet Air Force combat rescue/special operations mission requirements. Development, production, and support costs will be limited by maintaining commonality with the UH-60A and using Navy SH-60B Seahawk components to the maximum extent consistent with Air Force operational requirements and concepts. Improved avionics, auxiliary fuel tanks, air refueling capability, and necessary mission equipment will be integrated into the H-60, a helicopter with proven reliability, maintainability, and survivability. A version of the SH-60B engine will be used to provide the added performance needed due to the increased air vehicle weight and the more demanding Air Force missions. The suite of state-of-the-art avionics gear will significantly improve mission responsiveness and force survivability by providing a capability for low level flight at night or in adverse weather. System architecture will permit addition of new capabilities as parallel Army/Navy development efforts mature. Present plans call for a mix of adverse-weather-capable and visual-conditions-only systems.

3. (U) This will be an Air Force Designated Acquisition Program. Sikorsky Aircraft will build the basic airframe. The Air Force will conduct competition in as many other areas of the program as practical. As a minimum, competition will be conducted to select a systems integration contractor.

(U) RELATED ACTIVITIES: The following programs will produce systems/subsystems that are likely candidates for incorporation into the Air Force version of the H-60:

1. (U) Army:

a. (U) T700-GE-701 engine. This is a growth version of the current Black Hawk engine. Except for different materials used in a few parts, this engine is the same as the -401 engine used in the Navy SH-60B. Both the -701 and -401 engines have power ratings about 10 percent higher than the current UH-60A -700 engine. It is anticipated that the -701 will go into production for the AH-64 and should be available in 1984 for the Air Force program.

b. (U) Infrared engine exhaust suppression. The Army plans to develop a full-range UH-60A infrared engine exhaust suppressor. First production items should be available in 1983.

c. (U) UH-60A external stores support system. The Air Force will adapt this support for an external auxiliary fuel tank. Commonality of the fuselage attachment structure with the Army system will be retained.

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Program Element: #64753F

Title: Combat Helicopter Modernization
Budget Activity: Tactical Programs, #4

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

2. (U) Navy:

- a. (U) SH-60B hover in-flight refueling. The Air Force version will place the internal refueling receptacle above the main fuel tanks in a manner similar to that used on the SH-60B.
- b. (U) SH-60B transmission. The SH-60B main gear box will be used since it includes an integrally mounted rotor brake. The remainder of the transmission will employ UH-60A components.
- c. (U) SH-60B automatic flight control system. Flight controls will retain standard UH-60A system with the addition of hover coupling. The SH-60B approach and hover coupler concept will be incorporated.
- d. (U) SH-60B rescue hoist. The SH-60B external rescue hoist will be included with modification to increase cable length from 200 to 225 feet.

3. (U) Air Force: Survival Avionics System. The aircraft portion of this system will be incorporated into the Air Force version of the H-60.

(U) WORK PERFORMED BY: A System Program Office has been established by the Air Force Systems Command at its Aeronautical Systems Division located at Wright-Patterson Air Force Base, OH. Contractor for the basic airframe will be Sikorsky Aircraft. The Air Force will conduct competition in as many other areas of the program as practical. Bidders for the systems integration contract are expected to include: Collins, IBM, Sperry, Sikorsky and/or Norden, and possibly others.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.

2. (U) FY 1981 Program: Not applicable.

3. (U) FY 1982 Planned Program: Accomplish engineering design, order two test sets of avionics equipment, and initiate software program development. Begin modification to test and evaluation configuration of two production Black Hawk airframes -- one for aerodynamic, mechanical, and fuel system tests, the other for avionics and automatic flight control systems tests.

4. (U) FY 1983 Planned Program: Complete software program development and airframe modifications. Begin hot bench avionics integration testing and contractor flight test program.

5. (U) Program to Completion: Complete hot bench avionics integration testing and contractor flight test program. Accomplish Air Force flight test evaluations. Attain initial operational capability in FY 1986.

Program Element: #64753F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: Combat Helicopter Modernization
Budget Activity: Tactical Programs, #4

6. (U) Milestones:

- a. MAC/TAF requirements validation
- b. AFMENS approval
- c. Full-scale development decision (AFSARC I/II)
- d. Begin flight test
- e. Production decision (AFSARC III)
- f. Initial operational capability

Date

September 1979
November 1980
FY 1982
FY 1983
FY 1984
FY 1986

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64754F Title: Joint Tactical Information Distribution System (JTIDS)
 DOD Mission Area: Tactical Command and Control, #254 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	44,600	59,400	87,600	96,800	311,100	731,900

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is to develop a highly jam resistant, secure digital information distribution system for use in a tactical combat environment. The Joint Tactical Information Distribution System (JTIDS) is a joint development employing time division multiple access and spread spectrum techniques. The system will provide sufficient interconnectivity and capacity to permit rapid and secure exchange of the necessary command, control and status information among all equipped elements in the tactical theater.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds for the development of depot support equipment for the E-3A/ground terminal. Also includes funds for the continued full scale development of a fighter terminal and the necessary equipments to incorporate the terminal into first line fighter aircraft. The request is current as of December 1980, and is based on estimates prepared for the January 13, 1981 DSARC II milestone.

(U) Comparison with FY 1981 Budget Data:

RD. & E	FY 1980*	FY 1981*	FY 1982	FY 1983	Additional to Completion	Estimated Costs
	54,600	71,600	85,100	Estimate	Continuing	Not Applicable

*FY 1980 change due to offset for FY 1981 amended budget. FY 1981 change due to Congressional action.

(U) OTHER APPROPRIATION FUNDS:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
Aircraft Procurement: PE 27417	6,000	4,000	0	21,700	27,900	59,600
PE 27130/27133					1,177,780	1,177,780
Other Procurement: PE 27422			27,300	27,800	78,600	133,700

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Program Element: #64754F

Title: Joint Tactical Information Distribution System (JTIDS)
DOD Mission Area: Tactical Command and Control, #254 Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: There is currently no system in operation which provides the necessary, real-time information about the dynamic combat environment. Currently, information upon which to base critical operational decisions normally exists somewhere within a combat area, but may not always be available to the force element needing the data. The decision-maker, therefore, must base decisions on an incomplete knowledge of the current combat situation. Consequently, there is an urgent requirement for a system that will distribute essential information to all elements of the force. The system must secure the message traffic, work in a sophisticated jamming environment, and prevent hostile forces from intercepting and using the transmitted information. The Joint Tactical Information Distribution System (JTIDS) satisfies these requirements.

(U) The system will be structured to operate as an information distribution network into which tactical users transmit command and control, surveillance, position and status, or other significant combat information at specific time intervals. All of this information is immediately available to each net participant who may select for display or storage that portion of the information in which he is interested. The system will interconnect the E-3A aircraft, ground and shipboard command, control and surveillance centers, and combat and support aircraft.

(U) The program provides for the development, fabrication, and test of prototype terminal equipment for various applications and the demonstration of the readiness of the system for production. Also included in the program is the design, prototype fabrication, and test of the necessary interface equipment to permit the incorporation of terminals into first line fighter aircraft.

(U) RELATED ACTIVITIES: The Joint Tactical Information Distribution System development is managed by a jointly manned program office. Development, prototype fabrication, and test of terminal equipments for various applications of the services will be funded under this program element and will be conducted in conjunction with the other programs with which the equipments will ultimately be integrated.

(U) WORK PERFORMED BY: The Joint Program Office is located at the Electronic Systems Division, Hanscom AFB, MA. Work is also being done at the Aeronautical Systems Division, Wright Patterson AFB, OH; and the Electromagnetic Compatibility Analysis Center, Annapolis, MD. Initial system design and fabrication of prototype terminals for the E-3A were under contract to Hughes Aircraft Company, Fullerton, CA, under a subcontract to the E-3A contractor, the Boeing Company, Seattle, WA. A letter contract for the initial low-rate production of the Class I terminal for the E-3A and the surface interface terminal was let to Hughes in July 1980. Other major contractors include: MITRE Corp, Bedford, MA, system engineering support; Singer-Kearfott, Little Falls, NJ, Advanced Development Model fighter class terminal; International Business Machines (IBM), Owego, NY, surface terminal; International Telephone and Telegraph Corp (ITT), Nutley, NY, advanced capability terminals; McDonnell Douglas Aircraft Corp, St Louis, MO, and General Dynamics Corp, Fort Worth, TX, fighter cockpit integration studies; and ARINC Research Corp, Annapolis, MD, design-to-cost studies.

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Program Element: #64754F

DoD Mission Area: Tactical Command and Control, #254

TITLE: Joint Tactical Information Distribution System (JTIDS)

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Advanced development of the basic time division multiple access technique was completed under Program Element (PE) 63706F, Advanced Command and Control Capability, and PE 63727F, Advanced Communication Technology. The operational feasibility, flexibility, and potential of the system was demonstrated in Europe in conjunction with the E-3A Airborne Warning and Control System brassboard operational test in April 1973. The development of prototype JTIDS terminals for E-3A aircraft was completed. Development of JTIDS terminals for ground, ships, and fighter aircraft was initiated. A Joint Program Office (Air Force, Navy, and Army) was established to manage the program. A flight and bench test program was conducted with the Federal Aviation Administration to demonstrate the compatibility with other systems in the same frequency band. A limited frequency clearance has been approved. Fighter aircraft integration studies and concept definition studies for manpack terminal application were conducted. Fighter terminal prototypes completed initial operational testing. Development of a pod configuration of the fighter terminal was completed in preparation for further operational testing.
2. (U) FY 1981 Program: Developmental and initial operational testing of the ground interface equipment was completed. A production decision for the ground terminal is planned for late FY 1981. A full scale development contract for the fighter terminal will be awarded. Development of the necessary hardware and software to integrate JTIDS into the F-15 will be initiated. Development of fail-safe provisions to assure continued electromagnetic compatibility with air traffic control equipment operating in the same frequency band will continue.
3. (U) FY 1982 Planned Program: Initiate development of depot support equipment for the E-3A terminal. Full scale development of the fighter terminal will continue. Development of the necessary aircraft integration equipment will continue for the F-15 and begin for the F-16. Incorporation of the new joint service approved message standard will be initiated. Production of the Adaptable Surface Interface Terminal will begin under Program Element 27422F. FY 1982 estimates differ from last year's estimate due to inflation corrections.
4. (U) FY 1983 Planned Program: Continue development of depot support equipment. Full scale development of the fighter terminal and aircraft integration equipments will continue. Software modifications to incorporate the new message standard will also continue.
5. (U) Program to Completion: Development of depot support equipment will be completed. Development of the fighter terminal and integration equipment will also be completed and flight testing will be conducted in the F-15 in 1985. Production of the fighter terminal and F-15 interfacing equipment will be initiated in FY 1986. Production of the interface equipment for integration of the fighter terminal into the F-16 will be initiated in FY 1987. The first JTIDS-equipped F-15 and F-16 will be operational in FY 1987 and FY 1988, respectively.

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Program Element: #64754F

DoD Mission Area: Tactical Command and Control, #254

TITLE: Joint Tactical Information Distribution System (JTIDS)
Budget Activity: Tactical Programs, #4

6. (U) Milestones:

A. Waveform Decision	Feb 1976
B. Initial E-3A Prototype Delivery	Jun 1977
C. Start Surface Terminal Development	Jun 1977
D. Start E-3A (Class I) terminals low-rate initial production	Jul 1980
E. Start Fighter Terminal Full Scale Development	Jan 1981
F. Surface Terminal Production Decision	3QCY 1981
G. Fighter Terminal Production Decision	Jun 1986

*Date presented in FY 1981 Descriptive Summary

Revised program direction from the Office of the Secretary of Defense regarding the technology to be employed in the fighter terminal development has resulted in a revision of the program schedule.

Budget Activity: Tactical Programs, #4

Program Element: #64754P - Joint Tactical Information Distribution System

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Joint Tactical Information Distribution System will develop a highly jam resistant, secure digital information distribution system for use in a tactical combat environment. This joint development effort is a merger of the earlier efforts of Air Force (SEEK BUS) and Navy development programs.

(U) The feasibility of Time Division Multiple Access was demonstrated during the March 1973 E-3A brassboard flight test. Development testing will verify the design and demonstrate the system capabilities through a series of compatible and interrelated testing activities. Both contractor and government tests will be conducted to fully verify all system capabilities. These tests will occur throughout the development cycle of each class of terminal.

(U) An extensive flight and bench test program to demonstrate compatibility with air traffic control equipments operating in the same portion of the frequency spectrum has been completed. These tests, which were conducted under the auspices of the Office of Telecommunications Policy, Executive Office of the President, in conjunction with the Federal Aviation Administration, demonstrated that the Joint Tactical Information Distribution System can co-exist with the other systems in the band without harmful interference.

(U) Contractor developmental flight tests of the Class 1 Advanced Development Model terminal on the E-3A aircraft evaluated net entry, synchronization, operation, and jamming margin. All specific operating parameters of the Class 1 terminal were met or exceeded in test programs that were conducted in 1977 and 1978. Net management was assessed to be time consuming. Resolution of this problem is being addressed in net management studies and the development of a new net management time-slot assignment algorithm. Additional testing of the Class 1 full scale development model is planned for September-October 1981.

(U) Additional testing in 1979 of the multipath propagation and doppler shift did not cause any adverse degradation with the Joint Tactical Information Distribution System in the full anti-jam mode. Performance specifications were met under jamming conditions.

(U) During development flight tests at Eglin Air Force Base from November 1979 through October 1980, the Class 1 terminal was interfaced with the existing Tactical Air Control System through the Adaptable Surface Interface Terminal. Functional performance was successful. Detailed test and evaluation results will be published in January 1981.

(U) Contractor acceptance testing of the Singer-Kearfott advanced development models of a Class 2 terminal were completed late in 1978. The Naval Air Development Center completed bench and flight testing of this terminal in September 1979. Some net management, relative navigation, anti-jam, and TACAN operations were deficient. Further testing will be conducted during the pod-configured Class 2 Advanced Development Model tests starting in early 1981. The objective of packaging the functions in a fighter-sized terminal was successful.

(U) Electromagnetic Compatibility testing has begun in the United Kingdom to support frequency clearance in Europe.

2. (U) Operational Test and Evaluation: Testing of the Joint Tactical Information Distribution System is a multi-service (Army, Navy, Air Force, and Marine Corps) Development Test and Evaluation/Initial Operational Test and Evaluation program. Some service-unique testing will also be conducted. The Air Force Test and Evaluation Center will conduct Initial Operational Test and Evaluation for the Air Force and be the lead agency for multi-service Initial Operational Test and Evaluation. The other service operational test and evaluation organizations are the United States Army Operational Test and Evaluation Agency, the Navy Operational Test and Evaluation Force and the Marine Corps Operational Test and Evaluation Activity. The purpose of the tests will be to assess the operational effectiveness and operational suitability of Joint Tactical Information Distribution System airborne, shipborne, and ground terminals, and the ability to support both individual and joint service concepts in an operational environment.

(U) Test and Production Milestones:

E-3A Advanced Development Model Class I terminal Initial Operational Test and Evaluation

Adaptable Surface Interface Terminal Full-Scale Engineering Development terminal Initial Operational Test and Evaluation

Pod Advanced Development Model terminal preliminary Initial Operational Test and Evaluation

Adaptable Surface Interface Terminal production decision

E-3A Full Scale Engineering Development model Class I terminal Initial Operational Test and Evaluation

Class 2 (fighter) Full Scale Engineering Development terminal Initial Operational Test and Evaluation

Class 3 Advanced Development Model terminal Initial Operational Test and Evaluation

May-June 78

November 79-December 80

April-December 81
September 81

September-October 81

1985-86

To Be Determined

Initial Operational Test and Evaluation of the Joint Tactical Information Distribution System Class I terminal on the E-3A was conducted during May and June 1978 by the Air Force Test and Evaluation Center. During this time, a preliminary evaluation of the Joint Tactical Information Distribution System Time Division Multiple Access architecture was conducted. The purpose of the test was to determine communication coverage, E-3A system performance with the Joint Tactical Information Distribution System, and to provide an initial estimate of the operational effectiveness/suitability of this planned enhancement. Major emphasis was placed on assessing the resistance of the Joint Tactical Information Distribution System to electronic countermeasures. The test demonstrated

the potential to greatly enhance digital information distribution. Problems associated with the establishment of the Joint Tactical Information Distribution System net and net operations were identified during testing. The results of the E-3A system Initial Operational Test and Evaluation were reported in the Air Force Test and Evaluation Center E-3A Joint Tactical Information Distribution System Terminal Initial Operational Test and Evaluation Report, December 1978. The operational suitability could not be conclusively determined due to reliance on the contractor for system maintenance and support, the limited test period and the small number of failures. The test report recommended that further operational suitability testing of the Class I terminal should be conducted using Air Force personnel and representative preproduction assets.

(U) Additional Initial Operational Test and Evaluation of the Class I Joint Tactical Information Distribution System in the E-3A is scheduled for 15 September to 30 October 1981, using a preproduction terminal designated the Hughes Improved Terminal.

(U) The Initial Operational Test and Evaluation of three preproduction Full Scale Engineering Development Adaptable Surface Interface Terminals was conducted by the Air Force Test and Evaluation Center, assisted by the Army and Marine Corps, in a multiservice combined Development Test and Evaluation/Initial Operational Test and Evaluation. The Adaptable Surface Interface Terminal is designed to interface with existing command and control systems which use the Tactical Digital Information Link B (TADIL B).

(U) The Adaptable Surface Interface Terminal Initial Operational Test and Evaluation was conducted at Eglin Air Force Base, Florida, and Marine Corps Air Station, Beaufort, South Carolina, from November 1979 - December 1980. Principal units/facilities to which the Adaptable Surface Interface Terminal has been interfaced are an Air Force Message Processing Center, an Air Force Control and Reporting Center, an Air National Guard Control and Reporting Post, an Army AN/TSQ-73 Air Defense Command and Control System, and a Marine Corps Tactical Air Operations Center. Test results will be published in January 1981 and will be used for the Adaptable Surface Interface Terminal production decision.

(U) The Adaptable Surface Interface Terminal consists of two principal subsystems. The first is a translator-processor (computer) which converts existing Tactical Air Control System/Tactical Air Defense System messages passed over TADIL B into Joint Tactical Information Distribution System equivalents. The second subsystem is the Hughes Improved Terminal which performs signal transmission, reception, and related digital processing of the Joint Tactical Information System signal. Midway through the test (May 1980), the primary Adaptable Surface Interface Terminal computer was upgraded to make it representative of the higher capability equipment planned for production. While the contractor operated the equipment during the initial stages of the Initial Operational Test and Evaluation, military personnel assumed this role during the latter stages. However, maintenance was performed exclusively by contractor personnel with military personnel limited to over-the-shoulder observation. This was necessitated by the lack of technical data, representative support equipment, and hands-on maintenance training, and limited the operational suitability portion of the evaluation. A continuation of the Adaptable Surface Interface Terminal operational suitability assessment is planned for the July-October 1981 time period when technical data and support equipment will be available for the translator-processor. Service technicians will maintain the equipment during this period. Representative support equipment and technical data for the Hughes Improved Terminal are not expected to be available in 1981. As a consequence, hands-on maintenance of the Hughes Improved Terminal will be limited, and an operational suitability evaluation will need to be conducted in the future.

(U) A preliminary operational evaluation of Joint Tactical Information Distribution System implementation in fighter aircraft is planned for the April-December 1981 time frame. A Singer-Kearfott AN/URQ-28 Advanced Development Model terminal and associated support equipment are being installed in an AN/ALQ-76 pod which is designed for use only on-board Maverick-capable aircraft and makes use of existing controls, displays, and pylon interfaces. Three such pods will be flown on F-4 aircraft to evaluate the contribution of the Joint Tactical Information Distribution System in defensive counterair, close air support, and air interdiction mission roles. While the pod is intended primarily to give early hands-on fighter experience with the Joint Tactical Information Distribution Systems, the test may also reveal whether there is sufficient utility in a pod terminal to proceed to full-scale engineering development.

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(U) Initial Operational Test and Evaluation will be conducted on a preproduction fighter terminal installed internal in F-15 and F-16 aircraft during 1985-1986. Based on preliminary planning, these tests will be conducted primarily in the Eglin Air Force Base area with other ranges used as needed.

(U) The Class 3 (man-pack) terminal development has been deferred because of program funding limitations.

3. System Characteristics:

<u>Characteristic</u>	<u>Objective</u>	<u>Demonstrated to Date</u>
Frequency	960-1215 Mega Hertz	960-1215 Mega Hertz
Range	300 nautical miles (1200 nautical miles with relay)	300 nautical miles
Capacity	57.6 Kilo bits per second	57.6 Kilo bits per second
Users	2-2000	3
Message Error Rate	10 ⁻²	10 ⁻²
Anti-jam Margin		
Range Accuracy	300 feet at 150 nautical miles	To be determined

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64756F (#63746F) Title: Side Looking Airborne Radar
 DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Cost
	TOTAL FOR PROGRAM ELEMENT	10,999	22,700	29,800	19,200	37,200	162,021
2037	SLAR Sensors (formerly SLAR Sensors/Exploitation)	10,999	14,800	10,700	4,800		69,321
2451	SLAR Exploitation (Formerly Advanced SLAR Components)		5,900	17,100	14,400	37,200	88,700
2647	Manual Radar Reconnaissance Exploitation System (MARRES)		2,000	2,000			4,000

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This product oriented Program Element develops radar sensors, processors, software, and exploitation equipment for use on ground stations and reconnaissance aircraft including the RF-4C, TR-1 and potentially on the Advanced Tactical Airborne Reconnaissance System. The objective of this program is to develop and test advanced high resolution SLAR components and systems capable of collecting from an airborne platform, transmitting, processing, and exploiting reconnaissance and strike information during night and adverse weather conditions. Requirements include reliable detection, and location of fixed tactical targets from long standoff ranges, near real time data exploitation, and direct handoff to strike systems. This development is intelligence related due to the high resolution quantity and quality of the product achieved. Ground radar processing and exploitation is required to achieve the high resolution and provide for real time retasking of radar collection.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to: support deployed operations and test of advanced digital SLAR ground exploitation systems; continue development of an initial demonstration prototype of the TR-1 SLAR exploitation system and initiate nonrecurring engineering for the ground station; complete the prototype exploitation system critical design review on the Advanced Synthetic Aperture Radar System (ASARS); continue advanced development of SLAR electronic counter-countermeasures. The costs for projects 2037 and 2647 are government estimates based upon contractor proposals. The costs for project 2451 are based upon existing contracts and a government generic estimate for the Tactical Reconnaissance Exploitation Demonstration System.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	9,000	27,400	19,700	34,600	132,822
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OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #64756P (#63746P)

Title: Side Looking Airborne Radar (SLAR)

DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to develop and test advanced SLAR components and systems to meet operational adverse weather reconnaissance and strike requirements. SLAR reconnaissance systems provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other useful intelligence about targets under conditions in which non-radar sensors are ineffective.

Operational requirements include: reliable detection, location and strike of fixed, mobile, moving, non-emitting tactical size targets (jeep, truck, tank) from long ranges (to nautical miles) over wide areas (nautical mile swaths); near-real time air-to-surface data transfer (up to nautical miles); and near-real time processing and exploitation (less than nautical miles). The ability to selectively target is desired. Additionally, the capability to detect targets concealed by camouflage or foliage is desired. To meet these requirements, advanced digital sensor processing and exploitation technologies will be used. Current operational SLAR equipment is limited to a maximum range of nautical miles, which is inadequate for operation in a environment or for adequate border surveillance. Lack of near real time air-to-surface data transfer and use of analog optical image processing and exploitation limits information timeliness. Also, current SLAR systems have resolutions that are not sufficient for

In 1979,

the previous UPD-X program redefined as equal to ASARS. Competitive design of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) began in FY 1980.

(U) Additional efforts in this program include near term development and qualification of components and techniques required to reduce deficiencies in current operational SLAR systems in the areas of target positioning and electronic counter-counter-measures.

(U) RELATED ACTIVITIES: Program Element 63208P, Reconnaissance Sensors/Processing Technology, is performing advanced development efforts in foliage penetration radar techniques. Program Element 27431P, Tactical Air Intelligence Systems Activities is developing advanced techniques for managing tactical reconnaissance information. Exploited SLAR data will be an input to this system. Program Element 27215P, TR-1 Squadrons, procures operational Advanced Synthetic Aperture Radar System (ASARS) SLAR sensors and ground stations.

(U) WORK PERFORMED BY: This program is managed by Aeronautical Systems Division, Wright-Patterson AFB, OH, and supported by the Air Force Avionics Laboratory, Wright-Patterson AFB, OH, Rome Air Development Center, Griffiss AFB, NY, and Electronic Systems Division, Hanscom AFB, MA.

(U) Contractors for current efforts are: Control Data Corporation, Minneapolis, MN, modifies the automatic change detection device previously fabricated; Environmental Research Institute of Michigan, Ann Arbor, MI, provides program technical support; Goodyear Aerospace Corp, Litchfield Park, AZ, modifies a previously constructed digital radar processing device and develops exploitation prototypes; Texas Instruments provides software to support ground facilities procurement to support

This decision resulted in

Program Element: #64756F (#63746F)

DOD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Side Looking Airborne Radar (SLAR)
Budget Activity: Tactical Programs, #4

the RF-4C Squadron SLAR exploitation; Hughes Aircraft Corp, Culver City, CA, develops the ASARS and performs electronic counter-countermeasure analysis; Technology Services Corp, LaJolla, CA, performs electronic counter-countermeasure analyses; Ford Aerospace, Palo Alto, CA and E-Systems, Garland, TX are competing for development of the Tactical Exploitation Demonstration System (TREDS) to support TR-1 reconnaissance exploitation.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Fabrication of a digital radar processor device and an automatic change detection device was used to process data from an AN/APD-10 radar (the airborne segment of a currently operational RF-4C SLAR) demonstrated digital processing of a radar with 30 nautical mile range, 10 nautical mile swath, and 10 foot resolution. The final acceptance tests of the digital change detection device were completed and the operational demonstration of near-real time SLAR data transmission and processing was carried out in Europe (1976 COLDFIRE/REFORGER exercises).

(U) During Fiscal Year (FY) 1977, the UPD-X effort was initiated which includes design and fabrication of the Advanced Synthetic Aperture Radar System (ASARS) sensor. Advanced electronic counter-countermeasures technique analysis and design continued. Analysis of the combat utility of advanced SLAR exploitation data handling techniques were conducted during the 1977, 1978, 1979 and 1980 REFORGER exercises. Phase II was established as Initial Operational Baseline Component Prototyping and Phase III as Full Scale Development of Product Improvements to more closely align phase titles with conventional Air Force development efforts. During FY 1978, design and acquisition of an advanced brassboard image display, analysis and exploitation equipment continued. Assembly and checkout of the preproduction ASARS equipment began. Integration of the air-to-surface data transfer and ground processing portions of the advanced brassboard sensor system with the exploitation segment began. Planning for transition of appropriate portions of the program to the engineering development category commenced. Real time digital processing and exploitation was demonstrated in REFORGER 80 and for Congressional committee staffers and military personnel in the Washington, D.C. area.

2. FY 1981 Planned Program: Initial Operational Baseline Component Prototyping will continue. The ASARS sensor and initial digital processing system will be tested. The Advanced Digital Processing System (ADPS) will continue development through Preliminary Design Review and functional software modules will be completed. Real time digital processing and exploitation of ^{will be demonstrated in REFORGER 81} with automatic change detection. Development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) will begin. Procurement of the SLAR exploitation software to support the RF-4C squadrons will be initiated. NOTE: The Congressional authorization reduced funds by \$5 million.

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Program Element: #64756P (#63746P)

DoD Mission Area: Tactical Surveillance, Reconnaissance,
and Target Acquisition, #255

Title: Side Looking Airborne Radar (SLAR)

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program: The United States and the Federal Republic of Germany (FRG) through a formal agreement, will share the use of the SLAR digital ground processing equipment, designated as the Advanced Building Block Large Area Exploitation (ABLE), in Germany. Per the agreement, the FRG has the right to test and evaluate the ABLE system for three months to commence after US testing and evaluation. Development and test of the Advanced Synthetic Aperture Radar System (ASARS) Advanced Digital Processing System (ADPS) will be completed. Development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) will pass critical design review. Product improvement will continue. The FY 1982 estimate increased by \$9.4 million. The FY 1981 congressional reduction of \$5 million caused the TREDS contract award to slip six months and moved FY 1981 work into FY 1982. Project 2648 previously included in this program element (PE) was moved to PE 64616P.

4. (U) FY 1983 Planned Program: Development of the TREDS will be complete including integration of the ASARS ADPS. TREDS will deploy to Europe to complete testing. Product improvement will continue.

5. (U) Program to Completion: Test and evaluation for the TREDS will be completed in Calendar Year (CY) 1984 establishing the basis for the initial operational capability. Design of the TR-1 ground station will be complete leading to production decisions in CY 1984-CY 1985 for two systems. Product improvements will continue. The total estimated cost increased by \$29 million because of cost growth and schedule slip in the sensor development plus an increase in the estimated cost of the TREDS plus \$16 million for product improvements in FY 1983 through FY 1986.

6. Milestones:

Date:

A. Initiation of Phase I, Analysis and Digital Demonstration	Jul 1973
B. Complete Phase I	Sep 1977
C. Complete Phase II, Initial Baseline Prototyping	Oct 1981
D. Complete Phase III, Preproduction Prototyping	Dec 1984
E. Initial Operational Capability (IOC)	(Jun 1981)*

* Date presented in FY 1981 Descriptive Summaries.

Explanation of Milestone Changes: Phase II, Initial Baseline Prototyping was changed to Oct 81 to show the date of completion of SLAR participation in REFORGER 81. The IOC for the TR-1 system was added. Completion of the Pave Mover option was deleted because Pave Mover was moved to Program Element 64616P.

Budget Activity: Tactical Program, #4
Program Element: #63746F, Side Looking Airborne Radar

Test and Evaluation Data

1. (U) Development Test and Evaluation: The Side Looking Airborne Radar system development is based upon a building block approach to providing a Tactical Reconnaissance System called TR-1. The TR-1 Reconnaissance System acquisition is based on the follow-on U-2R. Test and Evaluation plans and reports of completed evaluations are documented in special access programs and will be made available to appropriately cleared personnel. Tests on the Advanced Synthetic Aperture Radar System sensor will begin in Fiscal Year 1981. Tests on the ground processing and exploitation station are planned for Fiscal Year 1983 through Fiscal Year 1984.

Developmental Test & Evaluation of the planned TR-1 SENIOR SPEAR Transportable Ground Intercept Facility capability is complete. This system completed integration and testing in October 1979, and Independent Operational Test and Evaluation in March 1980. The critical question is: "Can the system provide levels and timeliness of tactical wartime and wartime readiness information to meet theater commanders' requirements?"

The Side-Looking Airborne Radar program management direction provides direction to proceed with the development of the Advanced Synthetic Aperture Radar System and the Tactical Reconnaissance Exploitation Demonstration System managed by the Aeronautical Systems Division. The Advanced Synthetic Aperture Radar System effort is with Hughes Aircraft Company for development of the airborne sensor and the ground processor. The Tactical Reconnaissance Exploitation Demonstration System is being developed as a ground facility which supports the exploitation of SENIOR SPEAR Transportable Ground Intercept Facility as well as the Advanced Synthetic Aperture Radar System. Multiple program requirements are being addressed in the Advanced Synthetic Aperture Radar System and Tactical Reconnaissance Exploitation Demonstration System projects to meet the need for processing timely exploitation and reporting during peace, crisis and war. Specific system requirements for the and Test & Evaluation conducted for the apply directly to the planned follow-on procurement of the airborne sensors and ground elements for the TR-1. These tests are documented in the descriptive summary for program element PE 63746F.

2. Operational Test and Evaluation: An Operational Test and Evaluation of the Side Looking Airborne Radar exploitation segment will be held in conjunction with the TR-1 Reconnaissance System Operational Test and Evaluation. The purpose of the Operational Test and Evaluation is to evaluate the aggregate system capability to provide information to tactical commanders.

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Budget Activity: Tactical Program, #4
Program Element: #63746F, Side Looking Airborne Radar

(U) Air Force Test and Evaluation Center will plan and manage operational testing of the Advanced Synthetic Aperture Radar System, Tactical Reconnaissance Exploitation Demonstration System, and the TR-1 Ground Station. These segments are being developed to support the TR-1 Reconnaissance System and are discussed in the TR-1 Squadron Congressional Data Sheet. The Strategic Air Command, the Tactical Air Forces, Air Force Logistics Command, Air Force Systems Command, Electronic Security Command, Air Force Communications Command, and Air Force Training command will support the operational testing. Testing will be conducted as follows:

(U) Advanced Synthetic Aperture Radar System: Air Force Test and Evaluation Center will conduct an operational assessment of this System in conjunction with the Development Test and Evaluation in support of the sensor production decision. This initial assessment will be based on the limited capabilities of the sensor while operating with the Interim Digital Processing Station. An estimate will be made of the operational effectiveness and suitability of the sensor and will address both strategic and tactical mission requirements. Air Force Test and Evaluation Center will publish an operational assessment plan that will be integrated with the Development Test and Evaluation program. The full system capability will not be available during this time period therefore precluding a complete Independent Operational Test and Evaluation. A full operational assessment of Advanced Synthetic Aperture Radar Systems will be planned by Air Force Test and Evaluation Center as an integral part of the TR-1 Reconnaissance System interim operational capability evaluation. The full assessment will be conducted using the prototype Advanced Synthetic Aperture Radar System Deployable Processing Station which provides full sensor operational capability. Collected data will support production, identify any operational deficiencies, and recommend desirable growth potential to the basic system.

(U) Tactical Reconnaissance Exploitation Demonstration System: This development will provide an interim operational ground facility. This demonstration prototype will contain the same primary functions and interfaces of the final production facility, although at a reduced capability. Operational Test and Evaluation and Developmental Test and Evaluation will be combined to provide inputs for the final facility design and to evaluate the capability of the aggregate system to support the operational mission. Air Force Test and Evaluation Center will plan and manage the operational testing during the combined Developmental Test and Evaluation/Operational Test and Evaluation at Air Force Plant 42, Palmdale, CA, and at the designated operational location.

(U) TR-1 Ground Station: Air Force Test and Evaluation Center will plan and manage Operational Test and Evaluation of the final system. The Operational Test and Evaluation program will include the TR-1 Ground Station and will concentrate on changes/enhancements over the interim system operational capability. Operational Test and Evaluation will evaluate the aggregate system ability to support the required full operational capability. The scope of the testing will be determined by the extent of changes to the interim system.

(U) As described in the TR-1 Squadron Congressional Data Sheet, the Test programs for both the interim and final capabilities will evaluate the system as an integral unit. Air Force Test and Evaluation Center will publish reports upon completion of the operational assessment of the radar sensor and the interim and final capability test programs. These reports will provide estimates on the overall system operational effectiveness and suitability and identify any deficiencies.

Budget Activity: Tactical Program, #4
 Program Element: #63746F, Side Looking Airborne Radar

3. Systems Characteristics:

<u>ITEM/</u> <u>CHARACTERISTIC</u>	<u>PARAMETER</u>	<u>DEMONSTRATED</u>	<u>DEVELOPMENT TEST &</u> <u>EVALUATION/VERIFIED</u>	<u>OPERATIONAL TEST & EVALUATION</u> <u>TESTED/VERIFIED</u>
<u>SENIOR SPEAR</u>		YES		Electronic Systems Command/Air Force Test & Evaluation Center
		YES		Electronic Systems Command/Air Force Test & Evaluation Center
		YES		Electronic Systems Command/Air Force Test & Evaluation Center
		YES		Electronic Systems Command/Air Force Test & Evaluation Center
		YES		Electronic Systems Command/Air Force Test & Evaluation Center

ASARS

NO	Aeronautical Systems Division	Electronic Systems Command/Air Force Test & Evaluation Center
NO	Aeronautical Systems Division	Electronic Systems Command/Air Force Test & Evaluation Center
NO	Aeronautical Systems Division	Electronic Systems Command/Air Force Test & Evaluation Center
NO	Aeronautical Systems Division	Electronic Systems Command/Air Force Test & Evaluation Center

Budget Activity: Tactical Program #4
 Program Element: #63746F, Side Looking Airborne Radar

<u>ITEM/ CHARACTERISTIC</u>	<u>PARAMETER</u>	<u>DEMONSTRATED</u>	<u>DEVELOPMENT TEST & EVALUATION/VERIFIED</u>		<u>OPERATIONAL TEST & EVALUATION TESTED/VERIFIED</u>	
(U) TR-1		NO	Aeronautical Systems Division	Electronic Systems Test & Evaluation Center	Electronic Systems Command/Air Force Test & Evaluation Center	
		NO	Aeronautical Systems Division	Electronic Systems Test & Evaluation Center	Electronic Systems Command/Air Force Test & Evaluation Center	
		NO	Aeronautical Systems Division	Electronic Systems Test & Evaluation Center	Electronic Systems Command/Air Force Test & Evaluation Center	
		NO	Aeronautical Systems Division	Electronic Systems Test & Evaluation Center	Electronic Systems Command/Air Force Test & Evaluation Center	

(U) TR-1

All required operational characteristics verified by ten years of U-2R operation. Procurement organizations will perform normal acceptance flight test(s) of each aircraft.

Ground Station

Demonstrate near-real-time (near-real-time is defined as elapsed time from target collection to reporting of less than _____

(U) Reliability/Maintainability

SENIOR SPEAR. Interchangeability is assured under provisions of MIL-I-8500Z. Associated Aerospace Ground Equipment is designed to reduce the total maintenance effort to the lowest practical level. Maintainability analysis in accordance with MIL-M-265-12C is being accomplished for each increment of existing and new equipment. Prime Mission Equipment will utilize three levels of maintenance as under Air Force Regulation 66-14. All equipment must be capable of being maintained by a 5-skill level techni-

Budget Activity: Tactical Program, #4
Program Element: #63746F, Side Looking Airborne Radar

cian. Reliability testing is tailored in this case to insure that new equipment/capabilities do not degrade performance of the baseline operational system.

(U) Advanced Synthetic Aperture Radar System. The current development Statement of Work contains goals for airborne and ground system Mean Time Between failure. Detailed Reliability and Maintainability projection will be formulated as a result of critical design reviews during 1981.

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969

884

Project: #2037

Program Element: #64756P (#63746P)

DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #255

Title: Side Looking Airborne Radar Sensor
Title: Side Looking Airborne Radar Sensor (SLAR)
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is to develop the Advanced Synthetic Aperture Radar System (ASARS). Advanced Digital Processing System (ADPS), Electronic Scan Antenna, and interface with other radar collection systems. The radar system will provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other intelligence about targets under conditions in which non-radar sensors are ineffective. Operational requirements include real time processing to achieve reliable detection if possible.

(U) RELATED ACTIVITIES: Program Element 27431F, Tactical Air Intelligence Systems Activities, is developing advanced techniques for managing tactical reconnaissance information. PE 27215F, TR-1 Squadron, procures operational radar sensors, processors, and ground exploitation equipment.

(U) WORK PERFORMED BY: This project is managed by Aeronautical Systems Division, Wright Patterson Air Force Base, Ohio. The contractor for the current effort is Hughes Aircraft Corporation, Culver City, California.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: The ASARS development previously known as AN/UPD-X was initiated in 1974. Phase I, Analysis and Digital Demonstration was completed in 1977. The ASARS II began in 1977 to develop an interim processor capable of being deployed and an ADPS capable of processing Based upon the tactical commanders' urgent information needs, the requirement for TR-1 and real time night/all weather imagery was revalidated in 1979. This resulted in UPD-X being redefined as the ASARS II. The radar completed design and development in 1980 including environmental tests. The initial digital processing system design, development and integration was also completed. Hardware for the ADPS was procured and delivered.
2. FY 1981 Planned Program: The ASARS will be installed, integrated and tested in the aircraft. Integration and flight testing of the interim digital processing system will be completed. Integration of hardware for the ADPS will be completed. Functional software requirements documents will be complete leading to completion of the preliminary design review of the ADPS. Cost growth in sensor development forced funds to be redistributed from project 2451.
3. (U) FY 1982 Planned Program: Development and test of the ASARS will be completed (includes ADPS). The cost growth in sensor development caused the increase in required funds.
4. (U) FY 1983 Planned Program: The ADPS will be integrated with the Tactical Reconnaissance Exploitation Demonstration System. This project will be complete.
5. (U) Program to Completion: Not applicable.

Project: #2037

Program Element: #64756F (#63746F)

DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: SLAR Sensor

Title: Side Looking Airborne Radar (SLAR)

Budget Activity: Tactical Programs, #4

6. (U) Milestones:

	<u>Date</u>
A. Initiation of Phase I, Analysis and Digital Demonstration	Jul 1973
B. Complete Phase I	Sep 1977
C. Initiate development of the Advanced Synthetic Aperture Radar System	Sep 1977
D. Complete development, test and integration of the radar and initial processing system	Sep 1981
E. Complete Advanced Digital Processing System	Dec 1982
F. Integrate Advanced Digital Processing System with Tactical Reconnaissance Ground Exploitation Demonstration System (Project Complete)	Jul 1983

7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RD&E	10,999	14,800	10,700	4,800		69,321

8. (U) Comparison With FY 1981 Budget Data:

RD&E	9,000	4,300	4,000	5,100	50,422
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\$1,999 FY 1980 funds were reprogrammed into the project to fund a cost increase for radar development.

Project: #2451

Program Element: #64756F (#63746F)

DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: SLAR Exploitation

Title: Side Looking Airborne Radar (SLAR)

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The objective of this project is the development and test of advanced SLAR exploitation components and systems to meet operational adverse weather reconnaissance and strike requirements. SLAR reconnaissance systems provide a unique capability to penetrate clouds and other atmospheric conditions in daylight or at night, operate at ranges beyond defensive threats, and provide accurate location and other useful intelligence about targets under conditions in which non-radar sensors are ineffective. Extraction of intelligence from the SLAR sensor is critical to the successful employment of the total system.

Operational requirements include near-real time processing and exploitation (less than to achieve: reliable detection if possible) and location of fixed, mobile, moving, tactical size targets (jeep, truck, tank) over wide areas nautical mile swaths). To meet these requirements, advanced digital exploitation technologies will be used. Lack of near-real time image exploitation limits information timeliness of current operational SLAR systems.

(U) The Advanced Synthetic Aperture Radar System (ASARS) is the baseline operational sensor to be exploited. The development of the image exploitation/data handling segment for the ASARS system is the highest priority element of this project. This includes development of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) and design of the TR-1 ground system (TRIGS).

(U) RELATED ACTIVITIES: Program Element (PE) 27431F, Tactical Air Intelligence Systems Activities, is developing advanced techniques for managing tactical reconnaissance information. Exploited SLAR data will be an input to this system. PE 27215F, TR-1 Squadrons, procures operational ASARS and the TRIGS.

(U) WORK PERFORMED BY: This program is managed by Aeronautical Systems Division, Wright-Patterson AFB, OH, and supported by the Air Force Avionics Laboratory, Wright-Patterson AFB, OH, Rome Air Development Center, Griffiss AFB, NY, and Electronic Systems Division, Hanscom AFB, MA.

(U) Contractors for current efforts are: Control Data Corporation, Minneapolis, MN, modifies the automatic change detection device previously fabricated; Environmental Research Institute of Michigan, Ann Arbor, MI, provides program technical support; and Goodyear Aerospace Corp, Litchfield Park, AZ, develops exploitation prototypes. The prime contractor for the TREDS development and design of TRIGS is to be determined through competitive award to either Ford Aerospace Corp, Palo Alto, CA or E Systems, Garland, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: During 1974, the advanced SLAR development program, known as the AN/UPD-X, was initiated with three phases: Phase I, Analysis and Digital Demonstration; Phase II, Competitive Prototyping; and Phase III, Pre-Production Prototyping. A digital automatic change detection device was used to process data from an AN/ADP-10 radar set (the airborne segment of a currently operational RF-4C SLAR system) and will demonstrate digital change detection processing of a radar with 30 nautical mile range, 10 nautical mile swath, and 10 foot resolution. During FY 1976, Phase I

Project: #2451

Program Element: #64756F (#63746F)

DOD Mission Area: Tactical Surveillance, Recon-
naissance and Target Acquisition, #255

Title: SLAR Exploitation

Title: Side Looking Airborne Radar (SLAR)

Budget Activity: Tactical Programs, #4

test planning was completed. Factory checkout of the digital change detection device was completed. The final acceptance tests of the digital change detection device were completed and the operational demonstration of near-real time SLAR data transmission and processing was carried out in Europe (1976 COLD FIRE/REFORGER exercises).

(U) Analysis of the combat utility of advanced SLAR exploitation data handling techniques were conducted during the 1977, 1978, 1979 and 1980 REFORGER exercises. Phase II was established as Initial Operational Baseline Component Prototyping and Phase III as Full Scale Development of Product Improvements to more closely align phase titles with conventional Air Force development efforts. During FY 1978, design and acquisition of an advanced brassboard image display, analysis and exploitation system was initiated. This system, known as the Advanced Building Blocks for Large Area Exploitation (ABLE) is designed to address the exploitation of the large quantities of search mode data from a SLAR sensor and the management of exploitation assets. During FY 1979 and 1980, design and acquisition of ABLE exploitation equipment continued. The Air Force initiated design of TR-1 Exploitation Demonstration System (TREDS) to address exploitation of the unique modes of the Advanced Synthetic Aperture Radar System (ASARS). Integration of appropriate elements of the TREDS and the radar ground processing system were addressed in the design.

2. FY 1981 Program: Phase II, Initial Operational Baseline Component Prototyping will continue. Real time digital processing and exploitation of REFORGER 81 with automatic change detection. Development of the TREDS will begin. Congress reduced funding by \$5 million causing the TREDS contract award to be delayed six months. Some funds were shifted to project 2037 to pay for a cost increase in sensor development.

3. (U) FY 1982 Planned Program: Phase II, Initial Operational Baseline Component Prototyping will be completed. Development of the TREDS will pass critical design review. Phase II product improvements will continue. The United States and the Federal Republic of Germany (FRG), through a formal agreement, will share the use of the SLAR processing equipment, designated as ABLE, in Germany. Per the agreement, the FRG has the right to test and evaluate the ABLE System for three months to be completed about March 1982. Cost estimates increased for TREDS due to FY 1981 work moved to FY 1982 because of contract award delay caused by the Congressional budget reduction.

4. (U) FY 1983 Planned Program: Integration of appropriate elements of the Tactical Reconnaissance Exploitation Demonstration System (TREDS) with the radar ground processing system will be completed as a part of the initial production ground processing and exploitation system specification preparation. The demonstration system will deploy to Europe for initial operational evaluation.

5. Program to Completion: Test and evaluation of the TREDS will be completed in CY 1984.

Design of TR-1 ground exploitation system will be complete leading to production decisions in CY 1984-1985 for two systems. Product improvements will continue. The additional cost to complete includes deployment of the TREDS to Europe and \$16 million for product improvements in FY 1983 through 1986 (includes electronic counter-countermeasures and interoperability with the RF-4C radar).

Project: #2451

Program Element: #64756F (#63746F)

DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: SLAR Exploitation

Title: Side Looking Airborne Radar (SLAR)

Budget Activity: Tactical Programs, #4

6. Milestones:

	<u>Date:</u>
A. Initiation of Phase I, Analysis and Digital Demonstration	Jul 1973
B. Complete Phase I	Sep 1977
C. Complete Phase II, Initial Baseline Prototyping	Oct 1981
D. Complete Phase III, Preproduction Prototyping	Dec 1984
E. Initial Operational Capability	(Jun 1981)*

* Date presented in FY 1981 Descriptive Summaries.

(U) Explanation of Milestone Changes: Phase II, Initial Baseline Prototyping was changed to Oct 1981 to show the date of completion of SLAR participation in REFORGER 81. The Initial Operational Capability for the TR-1 system was added.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E		5,600	17,090	14,400	37,200	88,700

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	22,100	5,000	9,500	50,700
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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 64779F

Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)
 DOD Mission Area: Tactical Command and Control, #254
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	4,900	8,600	7,600	7,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: JINTACCS is a joint interoperability program to provide improved operational effectiveness of Service (Army, Navy, Air Force, Marine Corps) tactical command and control systems planned for use in support of joint operations through the 1980s. Air Force objectives are to: develop interface design standards with the other services; modify affected Air Force equipments; participate in testing and joint operational effectiveness demonstrations and recommend joint standards for adoption by the North Atlantic Treaty Organization.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 request provides for the continuation of interface planning, analyses and design. Systems integration and test planning will continue, system modifications will be performed, test support provided and Air Operations Compatibility & Interoperability testing will be initiated. Cost estimates for the JINTACCS program are based on experience gained in the Tactical Air Control System/Tactical Air Defense System Program. These estimates were made by the Air Force Systems Command and the Tactical Air Command on February 15, 1980.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	4,900	13,039	11,183	Continuing	Not Applicable	

(U) OTHER APPROPRIATION FUNDS: Not Applicable

975

975

Program Element: # 64779F

Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

DOD Mission Area: Tactical Command and Control, #254

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: JINTACCS was established in August 1977 as the successor to the Ground and Amphibious Military Operations (GAMO) Program. Its purpose is to improve the operational effectiveness of the Service (Army, Navy, Air Force and Marine Corps) command and control systems used in support of Joint Operations through the 1980s. Also incorporated are the intelligence facilities of the National Security Agency and the Defense Intelligence Agency. Consideration of NATO interoperability was added in 1978. The Services and Agencies are utilizing the program to develop common interface standards and to modify their command and control equipment and procedures as necessary to insure systems interoperability, compatibility and operational effectiveness. To facilitate management, the program is divided into functional segments including intelligence, air operations, amphibious operations, fire support, and operations control. Within the Air Force, the primary command and control facility interfaces to be analyzed and defined exist within the Tactical Air Control Center (TACC), Control and Reporting Center/Post, Direct Air Support Center, Airborne Warning and Control System, Airborne Battlefield Command and Control Center and the intelligence element supporting the TACC. An Air Force test facility identified as the Participating Test Unit is being established to evaluate Air Force modified command, control and communications elements and to support compatibility & interoperability testing and operational effectiveness demonstrations.

(U) RELATED ACTIVITIES: This program element supports Air Force participation in the JINTACCS Program (with the Army as the Joint Chiefs of Staff (JCS) Executive Agent). Service and agency activities are governed by jointly agreed upon and JCS approved documentation including the Technical Interface Concepts, and Technical Interface Design Plans. The Air Force Tactical Air Forces Interoperability Group (TAFIG), as coordinating authority, and the Air Force Systems Command program office maintain coordination with program managers for Tactical Air Control System Improvements, Joint Tactical Information Distribution System, Airborne Warning and Control System, Tactical Information Processing and Interpretation and Joint Tactical Communications, TRI-TAC.

(U) WORK PERFORMED BY: TAFIG is coordinating authority for Air Force participation in the JCS JINTACCS Program. Technical and Engineering responsibility is assigned to the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. The Tactical Air Command provides operational support, including a Participating Test Unit at the Air Force Tactical Systems Interoperability Support Center at Langley AFB, VA, to support compatibility & interoperability testing and operational effectiveness demonstrations. The primary JINTACCS support contractor is MITRE, a Federal Contract Research Center, located at Bedford, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Support for the development of the JINTACCS Technical Interface Design Plans and Technical Coordinating Committees continues. Studies were initiated for the planning, analysis and design of the intra-Air Force interfaces as well as interfaces between Air Force intelligence elements and other Service facilities. Test-only modifications were completed for the intelligence segment and compatibility and interoperability testing was initiated. An Air Force Participating Test Unit was established at the Air Force Tactical Systems Interoperability Support Center.

Program Element: #64779F

Title: Joint Interoperability of Tactical Command and Control Systems (JINTACCS)

DoD Mission Area: Tactical Command and Control, #254

Budget Activity: Tactical Programs, #4

2. (U) FY 1981 Program: Interface planning, analysis and design efforts will continue during FY 1981 as well as modification of test-only hardware and software. Test planning and support will be provided for the air operations compatibility and interoperability testing and operational effectiveness demonstrations. Technical Interface Design Plans - Test Edition should be completed. The Air Force will participate in the intelligence operational effectiveness demonstration as part of the Solid Shield 81 joint exercise. The reduction in program funding from prior years results from increased Air Force activity in the Air Operations phase and from the beginning of the acquisition of a test support system. The relative decrease in the FY 1981 estimate from previous estimates results from better estimates of test support system cost.

3. (U) FY 1982 Planned Program: Technical Interface Design plans will be refined. The air operations segment testing will begin. System modifications to support the testing of the remaining segments (amphibious, fire support and operations control) will continue. Test planning and support will be provided. The decrease in FY 1982 requirements results from a reduction in the estimated cost of the test support system required for the Air Force Participating Test Unit.

4. (U) FY 1983 Planned Program: Continue to refine Technical Interface Design Plans and to perform impact analysis and system integration. Operations control segment testing will be initiated and the Air Force will participate in the air operations operational effectiveness demonstration.

5. (U) Program to Completion: The remaining functional segments for the joint systems will be tested for compatibility and interoperability and will be followed by operational effectiveness demonstrations. The technical interface design plans will be updated and subsequently incorporated as standards into appropriate Joint Chiefs of Staff publications. Test completion is scheduled for 1985.

6. (U) Milestones: Not Applicable

977
9732
892 922

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27128P
DoD Mission Area: Counter Air, #221

Title: F-4 Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

<u>Project Number</u>	<u>Title</u>	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional To Completion</u>	<u>Total Estimated Costs</u>
	TOTAL PROGRAM FOR ELEMENT	500	6,800	6,400	6,700	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The F-4G Wild Weasel represents the only lethal defense suppression weapons system in the Air Force inventory. This system is specifically designed to automatically detect, identify, locate, and destroy hostile radar emitters by the use of anti-radiation missiles, standoff guided munitions, or conventional F-4 weapons. The F-4G is classically employed in the counter-air role as an escort for a penetrating strike force or independently as a hunter-killer force against targets of opportunity.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Engineering design and development of system updates are required to maintain the F-4G/APR-38 capability at a level commensurate with the ever increasing hostile radar threat environment. Engineering development of threat updates is on a priority basis to the stated needs of the tactical air force. Threat updates will be grouped to ease aircraft configuration control during F-4G modification periods, the first of which is expected to begin in 1986. Threat updates and various aircraft modifications require similar engineering efforts to maintain the F-4G simulator currency. Request is based on Air Force Systems Command pricing models.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY

RDT&E	FY 1980	FY 1981		FY 1982		FY 1983		Total	
		Estimate		Estimate		Estimate		Estimated Costs	Not Applicable
	500	7,300		6,100		Continuing			

(U) OTHER APPROPRIATION FUNDS:

FY 1980 Actual	FY 1981		FY 1982		FY 1983		Total	
	Estimate		Estimate		Estimate		Estimated Costs	Not Applicable
					Additional To Completion			

Procurement (aircraft)
(Quantity)

328,300
116

Program Element: #27128F

DoD Mission Area: Counter Air, #221

Title: F-4 Squadrons

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The USAF initially encountered radar controlled surface-to-air missile (SAM) weapons systems in North Vietnam in 1965. Wild Weasel configurations of the F-105 and F-4C were developed from off-the-shelf hardware as a quick reaction counter to this threat. The SAM and radar controlled anti-aircraft artillery (AAA) threat has continued to expand in both quantity and quality since then. Development of the F-4G Wild Weasel started in 1970 as a counter to this increasingly hostile threat environment. The F-4G/APR-38 system provides a cockpit display to identify the type of threat (SAM, AAA, etc.), and the azimuth to that threat.

It employs a phase interferometer antenna system to provide highly accurate target azimuth and elevation direction finding (DF) information, 360 degrees around the aircraft. Digital computer controls allow the location of a designated target to be carried in memory if the tracking emitter is shut down; the DF information is of the quality necessary to successfully execute blind delivery of area munitions via the memory function. With the information available in the cockpit, the aircrew has a range of attack options. If the emitter remains active during the engagement the crew can hand-off APR-38 data directly to an anti-radiation missile. Should the emitter shut down before an anti-radiation missile engagement can be completed, the crew can use the position data in the APR-38 memory to either cue them for visual delivery of conventional or guided weapons or allow them to execute a blind delivery of area munitions. Intelligence data suggests the threat will continue to increase in complexity and technical sophistication. This program will develop the updates necessary to maintain the F-4G simulator; engineering development efforts are required to install the navigation system changes into the simulator and to develop the required software interface.

(U) RELATED ACTIVITIES: Air Force advanced and engineering development program elements (PE 63718F - Electronic Warfare Technology, 64738F - Protective Systems, 64739F - Tactical Protective Systems) are currently developing the generic electronic warfare technologies necessary to counter the advanced threat radar. The Air Force and Navy are jointly developing the Airborne Self-Protection Jammer System (PE 64737F). The imaging infrared (IIR) Maverick and HARM are both programmed for interface with the F-4G (PE 27162F). New inertial navigation system is to be installed by Air Force Logistics Command as a Class IV modification and will interface with the APR-38. The above programs are responsible for funding and developing the required interfaces for the F-4G/APR-38 system; however, this program will ensure overall system compatibility/integration.

(U) WORK PERFORMED BY: Ogden Aerospace Logistics Center, Utah is responsible for the management of F-4G enhancement programs. Air Force Systems Command (AFSC); Air Force Test and Evaluation Center, Kirtland AFB, NM; and Tactical Air Command, Langley AFB, VA are jointly responsible for the testing of the F-4G. AFSC is responsible for the subsystem and interface development of F-4G/APR-38 enhancements. Contractors are: McDonnell-Douglas, St. Louis, MO - Airframe; IBM, Owego, NY - Receiver; LORAL, New York, NY - Display; Texas Instruments, Austin, TX - Processor; Singer-Link, Binghamton, NY - Simulator.

980
980
994

Program Element: #27128F

Mission Area: Counter Air, #221

Title: F-4 Squadrons

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Initial contracts to develop the APR-38 receiver system for integration into the F-4D aircraft were awarded in December 1970; F-4D development test and evaluation flight testing was completed in FY 1974. In January 1974, the Air Force Council expanded the program's scope for the following reasons: (a) force structure projection: (b) F-4D versus F-4E airframe service life; and (c) intelligence information gained from the 1973 Mid-east conflict. This redirection added a special warning receiver function, inflight recorder, and ground playback station; doubled computer memory capacity to increase the threat handling capability; converted to the F-4E aircraft; and for logistical support considerations, redesignated the weapons system F-4G. F-4G development test and evaluation/initial operational test and evaluation (DT&E/IOT&E), continued on the above mentioned items with flight test completion in August 1976. The IOT&E identified system deficiencies that necessitated returning the aircraft to DT&E. These deficiencies were (1) low-band location inaccuracy; (2) signal processing prioritizing and display errors, (3) improper indications from the special warning function, and (4) built-in-test malfunction. Follow-up DT&E/IOT&E began in September 1976 and was satisfactorily completed in February 1977. Full scale production of the F-4G was approved in March 1977.

The first production F-4G was delivered to Tactical Air Command in October 1977 and verification flight testing was satisfactorily completed in February 1978. The second aircraft was delivered in January 1978. These two aircraft entered follow-on test and evaluation on 6 February 1978; testing was satisfactorily completed on 28 July 1979. Production aircraft are delivering at the rate of three per month with the last (116th) F-4G to be complete in May 1981. Tactical Air Command achieved initial operational capability in April 1979 when the first squadron (24 primary aircraft authorization (PAA)) was declared combat ready. The full operational capability will be achieved in _____

Planned force structure beddown includes: (a) _____

With the exception of the ground playback station, all planned development for the basic F-4G was completed with FY 1977 funds. The Air Force completed the ground playback station in FY 1979. The Air Force started a threat update program in FY 1978 to ensure the F-4G maintains a viable operational capability against the constantly changing threat environment. Specific updates being addressed include: (1) _____
(3) increased computer capability; (4) component technology and technique updates to reduce system operations and maintenance costs; (5) _____

_____ In FY 1979 the Air Force completed the engineering development and design feasibility studies started in 1978 and assembled resulting data for evaluation.

Program Element: #27128F

DoD Mission Area: Counter Air, #221

Title: F-4 Squadrons

Budget Activity: Tactical Programs, #4

2. FY 1981 Planned Program: The Air Force plans to start full scale development of an APR-38 performance update as a result of the FY 1980 data evaluation. The program will be in two phases. Phase I will concentrate on expanding the on-board computer capability so the F-4G will have the needed memory to interface with the AGM-88, high-speed anti-radiation missile. Both computer expansion and AGM-88 are planned for operations. Phase II will engineer the other hardware and software changes identified in the FY 1980 evaluation. These changes are scheduled to be operational in

3. (U) FY 1982 Planned Program: The Air Force will continue the engineering efforts started in FY 1981.

4. FY 1983 Planned Program: The Air Force will continue the engineering efforts started in FY 1981 and will investigate available technology

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27129F

Title: F-111 Squadrons

DoD Mission Area: Interdiction/Naval Strike, #223

Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	95	5,300	2,800	3,800	Continuing	N/A
2056	PAVE TACK/VATS	(8,540)*	5,300	2,800	1,000		
No project F-111 Avionics Improvement		95			2,800	Continuing	N/A

* PAVE TACK/VATS funded under PE 64709F prior to FY 1981

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides funds for the PAVE TACK Forward Looking Infrared target acquisition and laser designator/ranger development to enable tactical aircraft to deliver precision guided and unguided weapons during day, night, and limited adverse weather conditions. One of the most pressing deficiencies in the Interdiction/Naval Strike mission area is the limited ability to interdict the enemy's forces at night and beneath low ceilings in the European theater. These limitations also restrict the Air Force's ability to exploit minimum altitude aircraft tactics. The PAVE TACK system responds directly to these mission needs of the early 1980s. The Video Augmented Tracker System is a much improved scene stabilizing technique which will free the crew members for defensive maneuvers during an active attack.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Video Augmented Tracking System will be fully integrated into the PAVE TACK pod. The integrating Contractor will complete his software development and the initial in-house testing. The operational flight program final reassembly will be accomplished and the PAVE TACK operational test program will be modified to include the Video Augmented Tracker design. Support equipment design for the Video augmented tracker will be completed. Cost estimate for Video Augmented Tracking System development is based on current test experience and projected contract maintenance costs. FY 82 cost estimate is reduced from estimate in FY 1981 Descriptive Summary based on more current current projections of PAVE TACK engineering changes.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:							Total Estimated Costs
	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion		
RDT&E	1,400	7,300	8,000	-	11,400		44,000

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #27129F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: F-111 Squadrons

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The F-111 force represents a unique capability to conduct specialized attack missions during daytime, darkness and adverse weather. The F-111 aircraft constitutes a viable element of the Air offensive counter-air missions against the known threat requiring accurate target acquisition before effective weapons delivery can be accomplished. Target acquisition, designation and attack capabilities currently exist for day visual conditions; however, deficiencies remain during night and adverse weather conditions. The PAVE TACK project which was transferred to this program element was developed to provide a precise night and limited adverse weather target acquisition system common to F-4 and F-111 aircraft. A Forward Looking Infrared (FLIR) sensor, laser target designator/ranger, common stabilized and slewable optics for the infrared and laser systems and necessary digital control electronics are contained in a pod carried on the F-4 aircraft centerline and semi-submerged in the F-111 weapons bay. The F-4 and F-111 digital avionics permit flexible integration of the navigation equipment, weapons delivery computer, the radar and PAVE TACK sensors and guided weapons. PAVE TACK equipped aircraft are therefore capable of performing accurate low altitude high speed air-to-surface attack missions at night and during limited adverse weather using a variety of available weapons. PAVE TACK production for the F/RP-4 was initiated in July 1977; F-111F production started in August 1978. During FY 1980 the deficiencies identified during development and initial operational tests were corrected.

(U) RELATED ACTIVITIES: The Air Force common Forward Looking Infrared (FLIR) sensor used in the PAVE TACK pod was developed in Program Element (PE) 64710F, Reconnaissance Equipment. The development tasks conducted in PE 64728F, Tactical LORAN/F/RP-4 Digital Avionics, were critical to the success of the F-4 PAVE TACK program. PE 64733F, Surface Defense Suppression, has provided weapons integration support for the development of a single Group A aircraft wiring kit for PAVE TACK and guided weapons for the F-111F. The integration approach will allow for an efficient one time modification of the F-111F. The Video Augmented Tracking System, initially developed under PE 63203F, Advanced Avionics for Aircraft, was transitioned into the PAVE TACK project for integration and flight demonstration. Full scale development will be completed with the PAVE TACK project.

(U) WORK PERFORMED BY: All Air Force effort is being managed by the Aeronautical Systems Division, Wright-Patterson AFB, OH. The initial engineering study on upgrading the F-111A/E from the current analog system to a digital bomb/navigation system was performed by General Dynamics, Fort Worth, TX. The PAVE TACK contractors include: PAVE TACK Pod, F-4 Integration, Ford Aerospace, Newport Beach, CA (Prime Contractor); FLIR, Texas Instruments, Dallas, TX; Laser, International Laser Systems, Orlando FL; F-4/F-111 Cockpit Display, Texas Instruments, Dallas, TX and General Electric Corp, Utica, NY; F-111 Integration, General Dynamics, Fort Worth, TX. Flight test responsibility has been assigned to the Armament Division at Eglin AFB, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: During FY 1977 studies were conducted by Air Force Logistics Command and Air Force Systems Command on the feasibility of modification of the AN/AJQ-20A Bomb Navigation System (BNS) to provide

984

998 984

Program Element: #27129F

DoD Mission Area: Interdiction/Naval Strike, #223

Title: F-111 Squadrons

Budget Activity: Tactical Programs, #4

for carriage/delivery of modern weapons at supersonic speeds by the F-111A/E. Results of the studies concluded that refurbishment of the AN/AJQ-20A analog system was not cost effective. Replacement of the AN/AJQ-20A with a digital BNS was deemed to provide not only the capability for carriage/delivery of current inventory weapons by the F-111A/E but also provide growth capability for future systems. The initial engineering study revealed that F-111 A/E digital bomb/navigation update was too expensive for the projected increase in combat capability. The Air Force has decided to terminate the effort for other more cost effective programs for the tactical forces. The remaining effort within the PAVE TACK Project has been transferred from PE 64709, Improved Tactical Bombing, to this Program Element. The PAVE TACK pod development and F/RP-4 combined development and initial operational test and evaluation were completed in April 1977. Pod production and F-4 aircraft modification direction was provided in July 1977. The F-111F interface design and prototype hardware fabrication were completed with two test aircraft delivered, one in August 1977 and one in September 1977. The PAVE TACK F-111F development and initial operation tests began in September 1977 and were completed in September 1978. The F-111F aircraft modification direction was provided in August 1978. The F-111F flight test was completed in December 1979. The FY 1980 effort resulted in development of a Video Augmented Tracking System (VATS) and contractor maintenance support for VATS testing as well as supporting continued flight training of TAC crew in advance of production systems availability. VATS will reduce operator workload by 75% during critical target tracking phase of mission allowing operator to assist in survivability tasks. The basic production pod configuration contains all provisions for VATS without any modification.

2. (U) FY 1981 Program: The Pave Tack Integration with ARN-101 Navigation/Weapon Computer System will be completed. The Video Augmented Tracking System will be flight tested for F-111 and F-4 application.

3. (U) FY 1982 Planned Program: The Video Augmented Tracking System (VATS) will be fully integrated into the PAVE TACK pod. The integrating Contractor will complete his software development and the initial in-house testing. The VATS operation flight program final reassembly will be accomplished and the PAVE TACK operational test program will be modified to include the VATS design. The VATS support equipment design will be completed. Reduction in cost estimate results from more accurate information on remaining effort.

4. (U) FY 1983 Planned Program: The Video Augmented Tracking System will complete Development Test and Evaluation and Initial Operational Test and Evaluations. The system discrepancies, if any, will be corrected and reevaluation initiated.

5. (U) Program to Completion: Production modules for Video Augmented Tracker System will be installed in PAVE TACK pods through FY 1985.

6. (U) Milestones: Not Applicable

985
985-9860
899

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27130F
 DOD Mission Area: Counter Air, #221

Title: F-15 Squadrons
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		2,490	10,991	57,100	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The F-15 is a high performance, highly maneuverable fighter equipped with a long range look-down radar and a balanced mix of air-to-air weapons to provide an outstanding close-in visual and medium range all-weather kill capability. Designed specifically to gain and maintain air superiority against post-1975 threat aircraft, the F-15 will significantly upgrade United States Air Force Tactical Forces supporting the counter-air and tactical support missions. Equipage of the active force with the F-15 contributes to Reserve force modernization by releasing F-4s from the active component for conversion to Reserve and Guard units.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 request includes funds to continue F-15 conformal fuel tank certification tests, to continue integration of radar programmable signal processor improvements into the F-15, and to continue flight testing of radar, electronic warfare, and weapons updates including F-15 Advanced Medium Range Air-to-Air Missile integration and compatibility tests. The FY 1982 Amended Request also includes funds to initiate development, integration and flight test of F-15 air-to-surface enhancements. Cost estimates are based on the F-15 Program Office's annual RDT&E "Grass Roots" review, last completed in August 1980. The review includes analysis of our current experience with ongoing flight test support contracts, contractor proposals, and Air Force estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		500	9,100	—	26,600	2,141,890
Procurement (Aircraft) (Quantity)	1,052,700 (60)	860,600 (30)	956,300 (30)	—	654,300 (30)	12,079,400* (729)

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) (Quantity)	1,060,300 (60)	1,108,400 (42)	TBD (42)	TBD	TBD	TBD*
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* Includes initial spares

Program Element: #27130F

DOD Mission Area: Counter Air #221

Title: F-15 Squadrons

Budget Activity: Tactical Programs #4

(U) DETAILED BACKGROUND AND DESCRIPTION: Until deployment of the F-15, the F-4E was our finest air-to-air fighter. However, the F-4 has marginal capability in air combat against the MIG-21, models of which are expected to remain in the Soviet Block inventory through the 1980s. In addition, three new interceptors; the Flagon, Foxbat and Flogger are operating in significant numbers in Soviet tactical forces. Thus the fighter threat during the 1975-1989 period will range from simple, highly maneuverable, day visual fighters to all-weather interceptors with advanced fire control systems. At present, the F-15 is the only aircraft in the USAF inventory with the maneuverability, armament, and fire control system that can counter this post-1975 threat. Holder of six world time-to-climb records, the F-15 combines an advanced pulse doppler radar for long range detection and tracking with a mix of radar and infrared missiles and a 20mm rapid-fire cannon to provide a close-in visual and medium range all-weather kill capability. The F-15 has four model designations, the F-15A/B/C/D. The F-15C and its two-seat version, the F-15D, incorporate radar signal processor and Production Eagle Package (PEP) 2000 improvements. The programmable signal processor provides the capability to rapidly reprogram the radar via software changes and permits improved electronic counter counter measure performance, higher resolution, and the introduction of new radar modes, such as the track-while-scan when developed. PEP 2000 provides an additional 2000 pounds internal fuel, provisions for conformal fuel tanks, and increases maximum takeoff weight by 12,000 pounds. The single-seat A and two-seat B models do not have these improvements. The F-15 significantly upgrades the United States Air Force Tactical Forces performing combat air patrol, escort, and fighter-sweep missions. It has replaced the F-4E as our primary air superiority fighter in the force structure. Equipage of active forces with the F-15 and the resultant transfer of the F-4 is helping to continue modernization of Reserve and Guard forces. Based on the USAF need for increased night/adverse weather capabilities, we are initiating development beginning in FY 1982 of enhanced F-15 air-to-surface capabilities to be incorporated in subsequent aircraft buys.

(U) RELATED ACTIVITIES: The Tactical Electronic Warfare System for F-15 application is being developed in Program Element (PE) #64739F, Tactical Protective Systems. AIM-9L, AIM-9M, AIM-7F and AIM-7M (Advanced Monopulse Seeker) air-to-air missiles are being developed and procured for use on the F-15 under PE #27161F, Tactical Air Intercept Missiles. The Joint Tactical Information Distribution System (JTIDS) is being developed for use on multiple aircraft including the F-15 under PE #64754F, JTIDS. The Advanced Medium Range Air-to-Air Missile is being developed under PE 64314F and 63370F&N. Generic radar software algorithms, applicable to programmable signal processor radars, are being developed under PE #64201F, Aircraft Avionics Equipment Development, for possible use in the F-15 and other fighter aircraft.

(U) WORK PERFORMED BY: The F-15 development program is being managed by the F-15 Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. McDonnell-Douglas Corporation, St. Louis, MO, is the prime contractor for development and production of the F-15 aircraft. Pratt & Whitney Division of the United Aircraft Corporation, West Palm Beach, FL, is the engine contractor. Hughes Aircraft Company, Culver City, CA is the radar subcontractor to McDonnell-Douglas Corporation.

Program Element: #27130F

DOD Mission Area: Counter Air #221

Title: F-15 Squadrons

Budget Activity: Tactical Programs #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The F-15 is an outgrowth of the F-X program which originated in 1965 with an Aeronautical Systems Division effort to develop a "representative" F-X design. This effort culminated in an advanced fighter point-design study released in July 1966. While the Concept Formulation Package for the Advanced Tactical Fighter (F-X) was approved by the Secretary of the Air Force in August 1967 and supplemented in August 1968, significant controversy remained over F-X design criteria. The question of flexible versus specialized (air superiority) capability was deferred to the contract definition phase for a final tradeoff decision. In September 1968, Requests for Proposal were released to industry; four responses were received. In December 1968, contracts were awarded to three of these manufacturers for "contract definition" of the aircraft. Based on its technical and cost proposal, McDonnell-Douglas Corporation was announced "winner" of the F-X competition in December 1969. Airframe, engine and avionics requirements were specified and McDonnell-Douglas charged with overall system responsibility for the development and production of the F-15. Earlier, in August 1968, Air Force had released contracts for advanced engine development. After evaluating the proposals of two manufacturers, the Air Force selected Pratt & Whitney aircraft in March 1970 to develop and produce the F-15 engine. Finally, McDonnell-Douglas awarded a subcontract to Hughes in September 1970 for development of the F-15 radar. The remainder of this paragraph summarizes the significant events in the F-15 program from the beginning of full scale development in January 1970 to date. The air vehicle critical design review and the avionics equipment development review were completed in April and June 1971, respectively. From July 1971, efforts were directed to fabrication of components and flight test airplanes and extensive ground testing of subsystems. Three demonstration milestones were completed in February 1972, including the Engine/Inlet Compatibility Test, the Structural Test Major Subassemblies, and the Engine Preliminary Flight Rating Test (PFRT) Milestones. To obtain increased engine efficiencies over the PFRT engine (Series I configuration) the Air Force decided, in March 1972, to use the alternate design being carried as a parallel effort. This engine became Series II, the configuration planned for Military Qualification Tests and subsequent production. On 26 June 1972, at the "Roll Out" ceremony, the F-15 was officially christened the "Eagle". First flight occurred on 27 July 1972 beginning a highly successful flight test program. The flying qualities Air Force Preliminary Evaluation was completed in September 1972, with favorable results. The initial Airborne Avionics Performance Milestone was completed on 2 December 1972. Two structural demonstration milestones were completed in January 1973, including the Fatigue Test One Lifetime and Static Test to Critical Conditions. The Defense Systems Acquisition Review Council (DSARC) held on 15 February 1973 approved production go-ahead for the first F-15 wing. The F100 engine endurance qualification test, delayed beyond planned completion date of February 1973 by technical problems, was successfully completed on 12 October 1973. All major structural testing milestones were met when the fatigue tests to three and four lifetimes were completed in October 1973 and February 1974, respectively, and static tests for the major critical conditions were completed in March 1974. The increased production rate tooling DSARC was held on 17 January 1974 and approval was granted to proceed with the FY 1974 production of 62 aircraft and for the purchase of the increased tooling to produce it. The Air Force Development, Test, and Evaluation began at Edwards AFB in February 1974. The second wing DSARC was held on 15 October 1974 and

Program Element: #27130F

DOE Mission Area: Counter Air #221

Title: F-15 Squadrons

Budget Activity: Tactical Programs #4

approval was given for the FY 1975 procurement of 72 aircraft. The first two production aircraft were delivered to Tactical Air Command in November 1974. The External Stores Flutter Release Milestone was completed in August 1974. With the exception of a single aircraft conducting limited armament follow-on testing, all contractor Development, Test and Evaluation was completed in November 1974. F-15 Follow-on Test and Evaluation started in March 1975 and was completed in July 1976. All high angle-of-attack and spin testing was completed in August 1975. The Initial Operational Capability (IOC) for the first training squadron was delayed from July 1975 to September 1975 due to a strike at McDonnell-Douglas. The IOC for the first operational squadron was in October 1976.

The Equipment Qualified Milestone was completed in March 1977 and the Aerospace Ground Equipment In-Place Milestone was completed in May 1977. Flight evaluation of the Air Intercept Missile Evaluation/Air Combat Evaluation changes to the computer software, of F-15/F-16 radar mutual interference tests, and of the AIM-9L integration effort was completed in 1978. Air Force Development, Test, and Evaluation (AFDT&E) of the AN/ALR-56 Radar Warning Receiver "New Threat" program was completed in 1978. Contractor Development, Test, and Evaluation (CDT&E) and AFDT&E of the Jet Fuel Starter air start capability was completed in 1978. Development of the F-15 C/D model with Production Eagle Package 2000 improvements (2,000 lbs additional internal fuel, provisions for conformal fuel tanks, and capability for higher take-off gross weight), was initiated in mid-1976 and continued into 1980. Development and test of the radar programmable signal processor (PSP), which began in 1978, also continued through 1980. In October 1980, a PSP operational flight tape was released duplicating the current hardware radar functions and adding doppler beam sharpening for a 10:1 resolution improvement and additional electronic counter measures against velocity gate stealers. To verify the 12,000 lb higher takeoff weight capability of the F-15 C/D models and to demonstrate AIM-7/F-15 conformal fuel tank compatibility, a joint USAF/Israeli Cooperative Flight Test Program was initiated in mid-1980. FY 1980 efforts also included flight test evaluations of electronic warfare hardware/software threat updates and integration/certification tests of improved air-to-air weapons (AIM-9M and AIM-7M).

2. (U) FY 1981 Program: FY 1981 RDT&E funds (\$11.0 million) are being used for flight test (\$5.2 million), for air vehicle updates (\$4.5 million), and for general management and engineering support (\$1.3 million). Primary flight test efforts include evaluation of electronic warfare and radar software updates, generated in response to changing Soviet threats, and continued certification efforts on the conformal fuel tank. Earlier tests verified the aircraft's 68,000 pound gross take-off weight capability with the conformal tanks. Air vehicle updates include continued development and integration of radar programmable signal processor capabilities, such as track-while-scan, passive ranging, and additional Electronic Counter Counter Measure features; jet fuel starter improvements for increased air start capability; and improvements to various aircraft avionics interfaces.

3. (U) FY 1982 Planned Program: FY 1982 RDT&E funds (\$57.1 million) will be used to continue conformal fuel tank certification tests (\$11.0 million); to continue integration of radar PSP improvements into the F-15 (\$4.8 million); to

Program Element: #27130F

DOD Mission Area: Counter Air #221

Title: F-15 Squadrons

Budget Activity: Tactical Programs #4

continue flight testing of radar, electronic warfare, and weapons updates (\$3.6 million); to initiate F-15/Advanced Medium Range Air-to-Air Missile (AMRAAM) integration and compatibility tests (\$3.6 million); to initiate development, integration and flight test of F-15 air-to-surface enhancements for increased night/adverse weather capabilities (\$32.8M); and for management and engineering support (\$1.3 million). The FY 1982 RDT&E Request is \$47.5 million larger than the FY 1982 funding requirement identified in the FY 1981 President's Budget. This increase is to accelerate F-15 conformal fuel tank certification efforts, to accelerate F-15/AMRAAM integration and to begin development of F-15 enhanced air-to-surface capabilities. Our concerns with the growing threat and the need for rapid response have prompted us to initiate or accelerate these efforts.

4. (U) FY 1983 Planned Program: FY 1983 RDT&E funds will be used for air vehicle updates, flight test and management and engineering support. Efforts will include continuation of F-15/AMRAAM integration (\$10.5 million); continued radar updates (\$5.1 million); continued development, integration and flight test of F-15 air-to-surface enhancements (TBD); and flight test of radar, electronic warfare, and weapons updates (\$5.3 million).

5. (U) Program to Completion: This is a continuing program. The FY 1984 - 1986 RDT&E funding will be used to continue integration of improved radar modes into the F-15 (\$6.8 million); to complete F-15/AMRAAM integration (\$19.1 million); to complete development of air-to-surface enhancements; and for flight test of radar, electronic warfare and weapons updates (\$9.2 million). The total F-15 R&D program reflected in the FY 1982 Amended Request is larger than that reflected in the FY 1981 request. Funds have been added for F-15/AMRAAM integration (\$33.2 million); conformal fuel tank integration/certification (\$12.9 million); F-15 air-to-surface enhancements (TBD); and continued mission support, flight test, and other activities (\$8.0 million). The total program procurement request has also increased between the two budget submissions. Major increases for additional aircraft procurement (TBD), for procurement of base level avionics test equipment to support wartime flying requirements (\$82.3 million) and inflation were partially offset by lower procurement costs resulting from Congressional direction to increase F-15 production in FY 1981 (\$106.1 million) and adjustments for initial spares.

Program Element: #27130F

Title: F-15 Squadrons
Budget Activity: Tactical Programs #4

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6. (U) Milestones:

- A. Award Total System Development Contract
- B. Preliminary Design Review
- C. Critical Design Review
- D. Engine Preliminary Flight Rating Test
- E. First Flight
- F. Long Lead Release (Production Approval)
- G. First Wing Full Release
- H. Engine Qualification Test
- I. Fatigue Test-3 Lifetimes
- J. Increase Production Rate
- K. Begin Air Force Development, Test, and Evaluation
- L. Fatigue Test-4 Lifetimes
- M. Second Wing Release
- N. First Aircraft to Tactical Air Command
- O. Initial Operational Capability (First Tng Sq)

<u>Date</u>	
January 1970	
September 1970	
April 1971	
February 1972	
July 1972	
October 1972	
February 1973	
October 1973	
October 1973	
January 1974	
February 1974	
February 1974	
October 1974	
November 1974	
September 1975	

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

Test and Evaluation Data

(U) The F-15 test program was composed of Contractor Development Test and Evaluation (CDT&E), Air Force Development Test and Evaluation (AFDT&E), Air Force Initial Operational Test and Evaluation (IOT&E) and Follow-on Test and Evaluation. The purpose of CDT&E and AFDT&E was to provide necessary test and analysis data to assure that an operational air superiority weapon system would be available at the earliest practical time. Test objectives addressed compliance with specifications, established performance capabilities, evaluated handling qualities, etc. IOT&E was conducted throughout Development Test and Evaluation (DT&E) to evaluate the operational capability and suitability of the F-15 weapon system. A portion of Tactical Air Command's (TAC) IOT&E involved their participation in eleven F-15 Air Force Preliminary Evaluations (AFPE). Additionally, seven Initial AFDT&E were conducted during DT&E to permit Air Force Flight Test Center and TAC pilots to evaluate contractor fixes of mandatory correction items discovered during AFPEs and to accomplish early Air Force developmental and operational test objectives. Eighteen F-15As and two F-15Bs (two-seat version) were dedicated to the DT&E/IOT&E tests.

1. Development Test and Evaluation:

(U) As of 31 August 1980, the Air Force and McDonnell Douglas DT&E test teams had accumulated 7819 test flights and 9287 flight hours on F-15 test aircraft during the 97 months of F-15 DT&E. Major activities during CY 1978 and CY 1979 included Tactical Electronic Warfare System AFDT&E, Air Intercept Missile Evaluation/Air Combat Evaluation computer software change evaluations, F100 engine stall/stagnation and component improvement tests, F-15/F-16 radar mutual interference tests, improved 20MM ammunition tests, programmable signal processor CDT&E, F-15 C/D model DT&E, and numerous evaluations of weapon system improvements designed to satisfy recommendations resulting from earlier testing. The remainder of this paragraph summarizes the significant DT&E accomplishments in the F-15 program from the beginning of full scale development in January 1970 to date. The air vehicle critical design review and the avionics equipment development review were completed in April and June 1971, respectively. From July 1971, efforts were directed to fabrication of components and flight test airplanes and extensive ground testing of subsystems. Three demonstration milestones were completed in February 1972, including the Engine/Inlet Compatibility Test, the Structural Test Major Subassemblies, and

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Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

the Engine Preliminary Flight Rating Test (PFRT) Milestones. To obtain increased engine efficiencies over the PFRT engine (Series I configuration) the Air Force decided, in March 1972, to use the alternate design being carried as a parallel effort. This engine became Series II, the configuration planned for Military Qualification Tests and subsequent production. F-15 first flight occurred on 27 July 1972 beginning a highly successful flight test program. The flying qualities AFPE was completed in September 1972, with favorable results. The initial Airborne Avionics Performance Milestone was completed on 2 December 1972. Two structural demonstration milestones were completed in January 1973, including the Fatigue Test One Lifetime and Static Test to Critical Conditions. The F100 engine endurance qualification test, delayed beyond planned completion date of February 1973 by technical problems, was successfully completed on 12 October 1973.

All major structural testing milestones were met when the fatigue tests to three and four lifetimes were completed in March 1974. The Air Force Development Test and Evaluation (AFDT&E) began at Edwards AFB in February 1974. The external Stores Flutter Release Milestone was completed in August 1974. With the exception of a single aircraft conducting limited armament follow-on testing, all Contractor Development, Test, and Evaluation (CDT&E) was completed in November 1974. All high angle-of-attack and spin testing was completed in August 1975. The Equipment Qualified Milestone was completed in March 1977, and the Aerospace Ground Equipment In-Place Milestone was completed in May 1977. Flight evaluation of the Air Intercept Missile Evaluation/Air Combat Evaluation changes to the computer software, F-15/F-16 radar mutual interference tests, and the AIM-9L integration effort was completed in 1978. AFDT&E of the AN/AIR-56 Radar Warning Receiver "New Threat" program was completed and an interim flight test report published in 1978. The New Threats consisted of three major improvements. One feature allows the AIR-56 to sort out and analyze capability. A second modification gives increased capability

to detect threats that are

strated. However, the software tape still had New Threat related problems as well as some carry-over deficiencies from the current Operational Flight Program. Further development and testing is required before release. In 1978, CDT&E and AFDT&E of the Jet Fuel Starter air start capability was completed. Testing under the F100 Engine Component Improvement Program, including solutions to the F100 stall/ stagnation problem, continued throughout 1979 and into 1980. The susceptibility of the F100 engine to compressor stalls followed by

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Program Element: 27130F F-15 Squadrons

stagnations and the resultant durability problems have been areas of major concern. With incorporation of planned fixes, all of which have been tested, the current F-15 stall/stagnation rate of 1.0 incident per 1000 engine flight hours should be reduced. Development and test of the F-15 C/D model, Production Eagle Package 2000 improvement (2,000 lbs additional internal fuel, provisions for conformal fuel tanks and capability for higher takeoff gross weight), which was initiated in mid-1976, continued into 1980. CDT&E and AFDT&E of the C/D model began in February and May 1979, respectively. CDT&E of the improved monopulse AIM-7M began in October 1979. Finally, development and test of the programmable signal processor (PSP) for the F-15 radar, which began in 1978, continued into 1980. While containing some minor discrepancies, the first PSP operational flight program delivered in May 1980 was as good or better than current aircraft radar capabilities. The discrepancies will be corrected with a tape revision in October 1980. The development of the Raid Assessment Mode (RAM) has taken longer than originally expected and incorporation of the RAM is now targeted for about April 1981. Maintainability and reliability testing of the F-15 Weapon System was a special subject of Operational Test and Evaluation as discussed below.

2. Operational Test and Evaluations:

(U) Initial Operational Test and Evaluation (IOT&E): The F-15 IOT&E was part of a combined IOT&E/Air Force and contractor Development Test and Evaluation (DT&E) conducted at Edwards AFB, CA, using data from contractor and Air Force DT&E sorties flown July 1972 through 30 June 1975. The Initial Operational Test and Evaluation (IOT&E) was USAF directed, Tactical Air Command conducted, and Air Force Test and Evaluation Center monitored. The IOT&E provided estimates of system operational effectiveness and suitability in support of Defense System Acquisition Review Council decisions related to increased production rate. Specific test objectives addressed both air-to-air and air-to-ground mission roles. 4460 sorties were flown in the 2.5 year effort. Major findings were:

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Program Element: 27130F F-15 Squadrons

- (U) The aircraft had superior handling and flight characteristics. Improvements were requested to cockpit situation awareness cueing to assist pilots in taking full advantage of the aircraft capabilities.
- (U) Pilot workload was satisfactory, but certain fire control automation was requested for the close-in engagement.
- (U) AIM-7F/F-15 interface was satisfactory. Carriage problems and cueing errors were noted in AIM-9E testing.
- (U) F-15 was an effective platform for air-to-ground ordnance delivery.
- (U) The continual change of hardware and software throughout the test program precluded establishment of a data base for reliability assessments. The immaturity of the built-in-test and non-delivery of major segments of test equipment were major limiting factors in the overall suitability evaluation.

(U) Follow-on Test and Evaluation (FOT&E): The F-15 FOT&E was an independent test and evaluation managed by the Air Force Test and Evaluation Center (AFTEC) and conducted by the 58th Tactical Fighter Training Wing at Luke AFB, Arizona. The objectives of FOT&E were to verify the operational effectiveness and suitability, which included assessment of the logistical supportability, life cycle costs, and identification of desirable modifications or trade-offs for the production F-15 System. The FOT&E commenced in March 1975 and finished in July 1976 using a total of 1111 F-15 sorties and approximately 900 support sorties. Evaluation sorties were flown by AFTEC and Tactical Air Command pilots. Maintenance was performed by Air Force personnel.

The F-15 was found to be an excellent weapon system for air-to-air combat. The long-range, look-down capability of the radar made it extremely effective in intercept operations and allowed it to enter most engagements from a position of advantage. However, there were several major operational deficiencies identified during Follow-on Test and Evaluation which were felt to limit the full operational capability of the F-15A.

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The major operational deficiencies identified were (1) unreliable fuel supply to the engines in the event of aircraft electrical failure, (2) fuel transfer problems, (3) unreliable landing gear indications (4) fire control system problems and (5) The F-15 Program Office has taken action to correct each of these deficiencies. Improvements in the emergency boost pump ground check switch and the emergency power system are being incorporated into production aircraft and have been retrofitted into all previously delivered F-15s to eliminate unreliable fuel supply during electrical failures. Problems associated with fuel transfer pump malfunctions were corrected by providing more detailed information to the pilot on actions to be taken when a transfer malfunction occurs. A review was also initiated to determine whether additional cockpit cues of this malfunction were required. Action resulting from this problem was closed in April 1977. The landing gear position indicating system was corrected by minor engineering changes approved in October 1976 and February 1977. These changes have been in all production aircraft since February 1977 and were also retrofitted into all previously delivered F-15s. Fire control system problems were corrected by a central computer operational flight program update. Finally, solution to the problem has been identified and the fix will be included in the

(U) Test estimates of reliability/maintainability indicated that the F-15A will be malfunction free on 20 percent of it's sorties. It will return from a mission with the capability of further missions 50 percent of the time. Testing resulted in an estimate of 40 maintenance manhours per flying hour. The manpower requirement necessary to support a 72 aircraft wing were estimated at approximately 1000 authorizations.

In addition to the above testing, an Initial Operational Test and Evaluation (IOT&E) of the F-15 Tactical Electronic Warfare System (TEWS) was conducted by the US Air Force Tactical Air Warfare Center, Eglin AFB, Florida. The resources of the Armament Development and Test Center, the Naval Weapons Center, and the 6512 Test Squadron, Air Force Systems Command were used during the test. The test was conducted simultaneously with Air Force and contractor Development Test and Evaluation (DT&E) from February 1974 through October 1976. The IOT&E, Air Force directed and Air Force Test and Evaluation Center monitored, was comprised of 325 sorties. The purpose of this IOT&E was to evaluate the capability of the F-15 TEWS to protect the aircraft against

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Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

surface-to-air and air-to-air threats. Air Force personnel performed organizational level maintenance for the F-15 TEMS. However, intermediate and depot maintenance support was accomplished entirely by contractor engineers and technicians using interim special test equipment. Major conclusions are (1) basic system operation was verified,

(U) The TEMS has the potential to give the fighter pilot an electronic warfare (EW) capability far superior to that of previous tactical EW systems. A number of equipment design changes and software modifications have been implemented to correct both the functional deficiencies and to provide additional capability. These changes and modifications are currently being tested by the USAF Tactical Air Warfare Center in an extension of the previous Development Test and Evaluation (DT&E)/Initial Operational Test and Evaluation (IOT&E). Reports addressing ongoing testing of TEMS components, such as, Radar Warning Receiver threat updates and the Countermeasures Dispenser Set, will be published in late 1980.

(U) An IOT&E of the Overload Warning System (OWS) was conducted by the U.S. Air Force Tactical Fighter Weapons Center, Nellis AFB, Nevada. The purpose of this IOT&E was to evaluate the capability of the F-15 OWS to provide timely pilot warning of an impending aircraft overload condition. The OWS has the potential to reduce F-15 airframe damage resulting from flight overload situations as well as permitting more effective employment of the F-15. A report on this testing is scheduled for mid-1980.

(U) The Tactical Air Command (TAC) participated in the Air Force Systems Command conducted DT&E of the software programmable radar and will continue this involvement until this phase of testing is completed. TAC has initiated a Qualification Operational Test and Evaluation to evaluate the operational effectiveness and suitability, supportability, and maintainability of F-15s equipped with the improved radar. The modified APG-63 with fully developed software will provide the F-15 with increased Electronic Counter-Countermeasures,

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Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

improved target resolution, and the capability to expeditiously incorporate Track-While-Scan and Non-Cooperative Target Identification modes through software-only changes.

3. Systems Characteristics:

The F-15 is an advanced tactical fighter developed for the air superiority mission. It is a twin engine, single place, fixed swept wing airplane characterized by high thrust-to-weight and low wing loading for superior acceleration and maneuverability. The F-15 is equipped with a balanced mix of air-to-air weapons, ranging from medium range all-weather missiles to rapidfire 20mm cannon and provides an outstanding capability against the postulated enemy air threat.

A. Operational

	DEVELOPMENT ESTIMATE	DEMONSTRATED PERFORMANCE
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1. Max Mach No @ Altitude (Sustained/Burst)	2.3/2.5	2.3/2.5
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2. Max Mach No @ Sea Level (Sustained)	1.2	1.16
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3. Design Maximum Load Factor (80% Internal Fuel), g	7.33	7.33
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4. Maximum Buffet-Free Maneuver g (0.8M, 30K ft), g		
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5. Energy Maneuverability (Ps), fps		
-------------------------------------	--	--

- | | |
|----|------------------------------|
| a. | 0.9M, 30,000 ft, 5g, Mil Pwr |
| b. | 0.6M, 10,000 ft, 5g, Max Pwr |
| c. | 0.9M, 10,000 ft, 1g, Max Pwr |
| d. | 0.9M, 10,000 ft, 5g, Max Pwr |
| e. | 0.9M, 30,000 ft, 5g, Max Pwr |
| f. | 0.9M, 35,000 ft, 5g, Max Pwr |

Budget Activity: Tactical Programs #4

Program Element: 27130F F-15 Squadrons

B. Technical

1. Design Mission Take-off Wt, lb	40,000	41,491
2. Take-off Wing Loading, lb/ft	66	68
3. Uninstalled Thrust-to-Take-off Weight Ratio	1.17	1.15

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27131F (64225F)

Title: A-10 Squadrons

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Budget Activity: Tactical Programs, #4

(U) RESOURCE (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
		17,800	33,446	14,000	4,600	9,200	465,200
TOTAL FOR PROGRAM ELEMENT							

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The A-10 is a single seat, twin turbofan aircraft specifically designed for the Close Air Support (CAS) mission. High survivability is a primary design feature. It has a high velocity, rapid fire, 30 millimeter (mm) gun for increased target kill effectiveness and can carry a large and variable external load of conventional ordnance. Aircraft speeds range from 120 knots to a maximum of 450 knots. The A-10 is designed to operate in the European threat environment which includes a high density of 23mm antiaircraft weapons and infrared heat seeking and radar-guided surface-to-air missiles. The primary mission of the A-10 is to attack targets in close proximity to friendly forces in support of the ground battle.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 request will continue follow-on testing of chaff/flare and radar warning improvements. Development, flight test, and qualification of gun gas defectors will also continue. An increased capacity environmental control system will be developed and tested to provide adequate cooling during low altitude, hot day missions. The request also includes funds to continue minimal flight testing and laboratory and engineering support to resolve correction of service revealed problems. Completion of the development of the two-seat A-10B trainer configuration directed by Congress in the FY 81 Defense Appropriation Bill is included in the FY 1982 request. The FY 1982 RDT&E estimate was provided by the A-10 program office at Wright-Patterson AFB, OH and was based in part on contractor inputs.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	17,800	13,600	5,400		9,600	454,900
Procurement (Aircraft) 1/	894,900	493,200	415,400		876,200	5,528,000

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) 1/
(Quantity)

4,903,300
(747) 2/

1/ Includes initial spares

2/ Includes 14 two-seat A-10B trainer aircraft

Program Element: #27131F

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: A-10 Squadrons

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The A-10 is a specialized aircraft designed for the Close Air Support (CAS) mission. It will replace aging or less effective aircraft in CAS. Studies performed between 1967 and 1969 led to a firm definition of the mission requirements and an optimized set of aircraft characteristics. The development of the A-10 was initiated, using a competitive prototype approach, with "design-to-cost" management goals. The A-10 is a single seat, twin turbofan aircraft. High survivability is a primary design feature. The A-10 has been designed to operate in the intense anti-aircraft artillery (AAA) environment that is anticipated to be employed by enemy forces. The European threat environment includes a high density of 23 millimeter (mm) AAA weapons, infrared heat seeking and radar guided surface-to-air missiles. The aircraft has been hardened to counter the Soviet 23mm weapons and will carry those infrared and electronic countermeasures known to counter Soviet surface-to-air missile threat. The A-10 has an austere basing and extended air loiter capability. This aircraft has both a standoff and close-in capability to defeat enemy armor. The A-10 will utilize the Maverick missile when standoff tactics are employed and the GAU-8 30mm gun for close-in attack of enemy armor. The A-10 is highly maneuverable and can carry a large and flexible external ordnance payload.

(U) RELATED ACTIVITIES: The A-10 utilizes the General Electric TF34-100 engine which is a modification of the TF34-400 engine developed by the Navy for the S-3A (Anti-Submarine Warfare Aircraft), Program Element (PE) 24215N. The TF34-100 engine was developed by the Air Force for A-10 application and includes several cost saving features. The A-10 Program Office and Navy have worked closely to ensure a high degree of commonality between both engine models. The A-10 is the first weapon system to use the GAU-8 30mm gun system, developed under PE 64605F. The A-10 Program Office has overall management responsibility for the GAU-8. The cost of the gun development as related to integration and testing with the A-10 are borne by the A-10 element. The A-10 will also employ the Maverick AGM-65 (Tactical Air-to-Ground Missile), PE 27313F. Weapon System Trainers for the A-10 are being developed in PE 64227F. The Standard Inertial Navigation System being developed under PE 64201F is planned for integration into the A-10. The \$14.9M for PE 64201F is not shown in the A-10 RDT&E although the A-10 Selected Acquisition Report has included these costs in the A-10 Development. The Low Altitude Navigation and Targeting Infrared System for Night (LANTIRN) being developed under PE 63219F is planned for integration on the A-10 by a Class V Aircraft Modification.

(U) WORK PERFORMED BY: This program is managed by the A-10 System Program Office, Aeronautical Systems Division, Wright-Patterson Air Force Base, OH. The prime contractor for the A-10 is Fairchild Republic Company, Farmingdale, L.I., NY. The GAU-8 30mm gun contractor is General Electric, Burlington, VT. The TF34-100 engine is managed by the Deputy for Propulsion, Aeronautical Systems Division. The engine contractor is General Electric, Lynn, MA.

Program Element: #27131F:

DOD Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: A-10 Squadrons

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The A-10 was selected for development as the result of a prototype competition ending in December 1972. Comparative analyses showed that the A-10 would be more than twice as cost-effective as other candidate aircraft in supporting ground forces in a European environment. DOD approval was granted and the A-10 development contracts were awarded on 1 March 1973. The detailed design refinement of the A-10 began, and prototype aircraft testing and TF34-100 development continued. The subassemblies for the first test aircraft entered fabrication in December 1973 and were placed in the fuselage assembly jig in January 1974. The static test article also entered fabrication in January 1974. In response to Congressional direction on the FY 1974 budget, the quantity of Development, Test and Evaluation (DT&E) aircraft in FY 1974 was reduced from ten to six and a fly-off between the A-10 and A-7 was conducted. The A-10 was declared the winner in June 1974. The engine completed qualification testing in October 1975. The first DT&E aircraft was delivered in February 1975. The prototype aircraft completed testing in June 1975. DT&E testing was initiated in February 1975. Originally planned DT&E testing was completed in September 1977. Initial operational capability of the first operating squadron was accomplished October 1977. Follow-on DT&E testing of directed aircraft enhancements (Inertial Navigation System, internal chaff/flare system and ALR-69 radar warning system) is in progress. The DT&E aircraft have been modified to an Air Force Logistics Command (AFLC) supportable configuration. These aircraft will be used within Air Force Systems Command for follow-on A-10 testing and mission support testbed aircraft. Development and testing have been initiated to prevent excessive gun gases from entering the engine. Follow-on fatigue testing was initiated to verify changes required as a result of more severe operational usage as well as change required to increase the fatigue life from 6000 hours to 8000 hours.
2. (U) FY 1981 Planned Program: Continue follow-on testing of chaff/flare and radar warning systems to increase their operational effectiveness against the expected European threat. The follow-on fatigue life extension program will continue to verify the A-10 fatigue life of 8000 hours. The funding will also provide minimal support for flight test and laboratory and engineering efforts to resolve service revealed problems such as gun gas/engine compatibility. The two-seat A-10B trainer aircraft development, test cord qualification will be initiated.
3. (U) FY 1982 Planned Program: Includes effort to provide minimum sustaining flight test, laboratory and engineering support to resolve service revealed problems improve the environmental control system develop a ground warning system and evaluate potential avionics enhancements such as Low Altitude Navigation and Targeting Infrared Systems for Night (LANTIRN). The FY 1982 program funding increased by \$8.6 million for development of the two-seat A-10B, a ground warning system and for fact-of-life adjustment for inflation, continued laboratory and engineering support, correction of service problems, store certification and associated flight testing. The procurement estimate was increased by \$135.5 million as a result of adding 14 two-seat A-10B aircraft to the FY 1982 procurement program.
4. (U) FY 1983 Planned Program: Continue minimum sustaining flight test, laboratory and engineering support to resolve service revealed problems, improve ammunition storage and shipping containers, continue LANTIRN integration and evaluate potential avionics enhancements for improved self-protection. The FY 1983 program funding increased by \$0.8 million for continued development and test of a ground warning system and inflation. The procurement estimates were decreased by \$433.5 million as a result of ending the A-10 aircraft procurement after the FY 1982 program.

Program Element: #27131F

DDO Mission Area: Close Air Support/Battlefield Interdiction, #222

Title: A-10 Squadrons

Budget Activity: Tactical Programs, #4

5. (U) Program to completion: Follow-on development efforts are planned through FY 1986. An additional fiscal year (FY 1986) is provided at an increase of \$3.2 million. RDT&E efforts will generally be directed toward expanding capabilities and resolving service revealed problems.

6. (U) Milestones:

A. Award full-scale dev/prod contract	Mar 1973
B. Critical Design Review	May 1974
C. Complete GAU-8/A prototype demonstration	May 1974
D. Production Readiness Review	May 1974
E. DSARC IIIA & long lead production release	Jul 1974
F. Engine Qualification Test Complete	Oct 1974
G. First flight DT&E aircraft	Feb 1975
H. Fatigue test one lifetime complete	Oct 1975
I. First Single-Seat Production Aircraft Delivery	Nov 1975
J. DSARC IIIB major production decision	Feb 1976
K. Initial Operational Capability	Oct 1977
L. Activate USAFE Base	Jan 1979
M. First Two-Seat Production Aircraft Delivery	Dec 1983
N. Complete Follow-on Development Program	Sep 1986

*(Sep 1985)

* Date presented in FY 1981 Descriptive Summary.

Explanation of milestone changes: An additional fiscal year (FY 1986) is provided for minimal flight tests and laboratory and engineering support to resolve corrections of service revealed problems.

Program Element: #27131F

DoD Mission Area: Close Air Support/Battlefield Interdiction.#222

Title: A-10 Squadrons

Budget Activity: Tactical Programs.#4

1. (U) Development Test and Evaluation: In 1966, the Chief of Staff of the Air Force directed that action be taken to develop a new aircraft specialized for the Close Air Support mission. This direction reflected the need for an aircraft which would replace aging or less effective aircraft used in Close Air Support and to provide optimum Close Air Support at least cost. This requirement still exists and is being satisfied by the A-10. Contractor studies performed in 1967 and Air Force studies conducted in 1968 and 1969 led to a firm definition of the mission requirements and an optimum set of aircraft characteristics and avionics requirements. The development of the A-10 was initiated, using a competitive prototype approach, with "design-to-cost" management goals. The objectives of the prototype phase were to demonstrate that the primary characteristics of an optimum Close Air Support weapon system could be achieved and to gain confidence that the weapon system could be procured at a relatively low cost. The objectives of the prototype phase were met within the forecast cost and on schedule. On 28 February 1973, the Department of Defense approved the development of the A-10 and the Air Force awarded contracts to Fairchild Republic Company (airframe) and General Electric Company (TF34 engine) for this effort.

(U) An extensive review of the A-10 program was accomplished in July 1974 to determine if the A-10 was ready to enter low rate production. A detailed assessment of the test program and a review of the A-10's production readiness posture were made. The results of this review culminated in the approval to procure 52 A-10 production aircraft and to release \$39 million for long lead funding for the initial procurement.

(U) The TF34-100 engine completed qualification testing in October 1974. Continued testing of the two prototype aircraft until June 1975 supported the development program. The first Development Test and Evaluation aircraft was delivered in February 1975. The sixth and last Development Test and Evaluation aircraft was delivered in September 1975. These aircraft were used to test the following areas: aerodynamics, performance, freedom from flutter, 100 percent air loads, armament systems, subsystems, climatic/adverse weather testing and initial operational tests. The performance thresholds were met or exceeded with the exception of forward airstrip takeoff and landing distance. These parameter values were assessed and found to have little impact on the A-10's operational utility. All major test milestones required prior to the full rate production decision were accomplished. The bomb and strafe accuracy tests demonstrated the A-10's excellent weapon delivery capability. The A-10 technical risks were minimized prior to production go ahead.

(U) Follow-on Development Test and Evaluation testing is continuing for stores certification, avionics enhancement and gun/engine and engine/airframe compatibility improvements. The static article has successfully demonstrated freedom from permanent deformation at design limit load and the ability to withstand ultimate strength (1.5 times limit load). The A-10 was certified to 6000 hours service life in May 1976; however, current operational usage is more severe than originally forecast resulting in a service life of 4500 hours. The cold work of some 1400 fastener holes in the center wing section is required to achieve at least 6000 hours based on the current, more severe operational usage. Three fatigue test failures since the certification have confirmed the cold work of the fastener holes in the center wing section and have resulted in a decision to thicken the outer wing section skin panels to extend the wing life to 8000 hours. Additional testing is being conducted to validate an 8000 hour service life with the more severe

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operational usage. The updated operational usage, although more severe on the wing, has no impact on the aft fuselage and empennage which have demonstrated an economic life of 16000 hours. The remainder of the fuselage and nacelles have demonstrated 6000 hours and are expected to achieve 8000 hours without major difficulty. In June 1978 and again in the summer of 1979, engine rollbacks during gunfiring were experienced. An extensive flight test investigation was initiated and interim and permanent solutions are being developed. Both solutions involve diverting the hot gun gases away from the engine. The interim solution is being tested operationally on a limited number of aircraft prior to incorporation on all A-10s.

(U) Follow-on Development Test and Evaluation testing of gun/ engine compatibility improvements and selected enhancements (internal chaff/flare, inertial navigation system and ALR-69) is now in progress. Work has started on modifying the Research, Development, Test and Evaluation aircraft to an Air Force Logistics Command supportable configuration. These aircraft will be used within Air Force Systems Command for follow-on testing requiring the use of A-10 test bed aircraft.

2. (U) Operational Test and Evaluation: Phase I Initial Operational Test and Evaluation of the A-10 was conducted in conjunction with Development Test and Evaluation of the prototype YA-10 aircraft from March 1973 through June 1975. Phase II Initial Operational Test and Evaluation, using six preproduction aircraft and later three production aircraft, began in April 1975 and was completed in March 1976. Limited aircraft availability prohibited evaluation of multiship employment concepts and tactics; however, adequate data were available to make an assessment of the A-10A aircraft.

(U) The combined Development Test and Evaluation/Initial Operational Test and Evaluation for the preproduction aircraft was conducted at the Edwards Air Force Base, George Air Force Base, and Nellis Air Force Base ranges. An Air Force Test and Evaluation Center test team composed of personnel from Air Force Test and Evaluation Center, Tactical Air Command, Air Force Logistics Command, and Air Training Command conducted the Initial Operational Test and Evaluation portion of the test. The purpose of the Initial Operational Test and Evaluation was to evaluate the operational suitability and operational effectiveness of the A-10 preproduction aircraft. Missions were flown to evaluate the aircraft, airborne performance, and handling qualities; pilot workload; air refueling capability; weapons delivery accuracy; defensive combat maneuvering capability; and night/weather operations. In addition, the close air support missions (support of troops, convoy escort, preparatory attacks, armed reconnaissance, and combat search and rescue) were evaluated. The interface of the GAU-8 gun with the A-10 was a primary objective. Data were gathered and analyzed to evaluate the A-10 survivability, reliability, maintainability, logistic supportability, and maintenance training requirements.

(U) Follow-on Operational Test and Evaluation was accomplished in two phases. Phase I, conducted by Air Force Test and Evaluation Center and the 355th Tactical Fighter Wing, commenced in August 1976 and was completed in February 1977. This phase involved six production aircraft flying 388 sorties. Test location was Davis-Monthan Air Force Base with deployments to Nellis Air Force Base and McChord Air Force Base for accomplishment of surge and low visibility test objectives. Based on the results of phase I Follow-on Test and Evaluation, Air Force Test and Evaluation Center has concluded that the production A-10A can perform the close air support mission better than any existing aircraft in the United States

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Air Force inventory. Although some aircraft performance thresholds were missed, the overall performance is satisfactory in the context of tailoring loads and tactics to the specific missions. Primary weapons include the AGM-65 Maverick missiles and the 30 millimeter gun. The 30 millimeter gun is a superior weapon when attacking current and projected Warsaw Pact front line armor. Excellent accuracy is achieved even when firing beyond 4000 feet slant range.

(U) Lack of sophisticated avionics has relegated the aircraft to daytime usage in a high threat environment. With low altitude target ingress, dead reckoning navigation causes an excessive pilot workload. Therefore, an inertial navigational system is needed. In the low ceiling/visibility environment, the aircraft's capability to attack small passive targets is unmatched by any other aircraft in the inventory.

(U) The A-10A is well suited to forward operating location operations. Medium weight takeoffs and landings resulted in average distances of 2175 feet and 1600 feet respectively. The simplicity of the aircraft and the self-contained power unit combine to aid in quick and safe turnaround operations.

(U) Aircraft reliability, as measured by Mean Time Between Failure was excellent. The Mean Time Between Failure of 1.8 hours was better than the predicted value of 1.34 and the Decision Coordinating Paper number of 1.78. Maintainability, as measured in maintenance man-hours per flying hour, closely approximated the predicted value of 26.0 maintenance man-hours per flying hour. Availability was also satisfactory with the flyable rate slightly below the prediction of 61 percent.

(U) Major deficiencies identified during the test were inadequate stability augmentation, unsatisfactory night lighting and a limited use head-up display. The first two deficiencies have been corrected, and work is continuing on the head-up display. The above information is from the phase I Follow-on Test and Evaluation Final Report, May 1977. However, the head-up display deficiency has now been corrected.

(U) Phase II follow-on test and evaluation conducted by Tactical Air Command and the 354th Tactical Fighter Wing using operational squadron aircraft, began in January 1978 and terminated in June 1978. Follow-on Test and Evaluation was conducted at Myrtle Beach Air Force Base SC with deployment/employments to Shaw Air Force Base SC and Savannah Airport GA. The objectives of phase II Follow-on Test and Evaluation were to verify the data gathered during phase I as applied to an operational squadron and to document the A-10 weapon system capability when employed in squadron strength operating from both a permanent base and deployed in forward operative locations. This latter objective included the operation under normal and surge sortie rates.

(U) Aircraft availability was very good during the test, especially in view of system maturity. Reliability and maintainability were very good. Phase II test values were 21.78 maintenance man-hours per flying hour and a Mean Time Between Failure of 4.47 hours; predicted values were 21.00 and 1.78, respectively. Aircrew training requirements were completed with relative ease due to aircraft availability. Logistics supportability revealed initial spares supply level deficiencies concerning engine related items, and provisions were made to correct the situation. All operational

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effectiveness objectives were met. The 24 primary aircraft authorized A-10 squadron with its mobility support package showed an excellent capability to mobilize, deploy, and perform its mission under normal and surge sorties from both a fixed base and deployed forward operating locations.

(U) The phase II Follow-on Test and Evaluation report, July 1979, concluded that A-10 availability, from either a main operating base or a forward operation location, was excellent. Weapon system reliability and maintainability were satisfactory during the evaluation. The deficiencies encountered in the test consisted of inadequate technical data, an unreliable aircraft boarding ladder and the unavailability of the GAU-8 automatic loading assembly. All of these deficiencies are being corrected.

(U) The next programmed test is a Follow-on Test and Evaluation the A-10 Inertial Navigation System. This test is programmed to begin in January 1981.

3. (U) System Characteristics: The significant A-10 performance parameters with the Decision Coordinating Paper goal/ threshold values are shown below.

<u>CHARACTERISTIC</u>	<u>DEVELOPMENT ESTIMATE</u>	<u>DEMONSTRATED PERFORMANCE</u>
Cruise Speed (KTAS)	300	342
Forward Airstrip <u>1/</u> Take-off (ft)	1200	1900
Landing (ft)	1200	1460
Loiter at 250 NM Radius (hr) Close Air Support Mission Anti-Armor <u>4/</u>	2.0 <u>2/</u> -	1.8 <u>3/</u> 1.8 <u>5/</u>
Bombing Accuracy, MK-82 (CEP)(mils)	15	13.6
Strafing Accuracy (CEP)(mils)	10	4
Sustained Load Factor <u>2/</u> at 275 Kt (g) at 150 Kt (g)	3.5 2.2	3.2 2.0

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(U) NOTE: All values for tropic day conditions. The "current" values reflect the best estimate or if available demonstrated values with all configuration changes included.

- 1/ (U) 4 MK82, 750 rounds of 30mm ammunition and fuel for 50 NM cruise to target, 30 minute loiter, combat, 150NM return to base, and land with fuel reserve
- 2/ (U) 18 MK82, 750 rounds of 30mm ammunition, and fuel for combat and land with fuel reserve 3/ (U) 16 MK82, 750 rounds of 30mm ammunition, and fuel for combat and land with fuel reserve
- 4/ (U) 6 Mavericks, 1350 rounds of 30mm ammunition, two ECM pods, full chaff/flare system, same mission profile as close air support mission
- 5/ (U) Estimated
- 6/ (U) 6 MK82, 750 rounds of 30mm ammunition, fuel for 300 NM, land with fuel reserve

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27133F (64229F)
DOD Mission Area: Counter Air, #221

Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	<u>TOTAL FOR PROGRAM ELEMENT</u>	<u>29,600</u>	<u>42,200</u>	<u>43,000</u>	<u>42,000</u>	<u>66,000</u>	<u>1,050,800</u>

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program will satisfy mission need for a lightweight, high performance, multi-mission fighter capable of performing a broad spectrum of tactical air warfare tasks at an affordable cost. The F-16 is designed for high sortie rates with rapid turnaround, minimum manpower/logistics burden, and exceptional air combat maneuvering performance coupled with a potent air-to-surface weapons delivery capability. The F-16 will replace aging F-4s in the active inventory as well as modernize the Reserve Forces.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request will support continued F-16 airframe, radar, engine, and stores certification flight tests. Test efforts will focus on those areas that are being identified during initial field operations, and on development of a radar improvement designed to provide increased air-to-surface capability and enhanced utilization of beyond visual range air-to-air missile on the F-16. Cost estimates are based on annual "GRASS ROOTS" program office estimating procedures.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
RDT&E	<u>27,800</u>	<u>42,300</u>	<u>8,000</u>		<u>9,100</u>	<u>915,400</u>
Procurement (Aircraft)** (Quantity)	1,656,500 (175)	1,877,300 (180)	1,506,700 (120)		9,335,700 (663)	17,549,900 (1,388)

(U) OTHER APPROPRIATION FUNDS:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
Procurement (Aircraft)** (Quantity)	<u>1,659,900</u> (175)	<u>1,953,300</u> (180)	<u>1,647,600</u> (96)	<u>1,679,700</u> (96)	<u>10,799,000</u> (591)	<u>20,855,000</u> (1,388)

**Includes initial spares.

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Program Element: #27133F (64229F)

DOD Mission Area: Counter Air, #221

Title: F-16 Squadrons

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The F-16 Multimission Fighter will provide the Air Force with a means of modernizing and expanding the Tactical Fighter Force under tight fiscal and manpower constraints. Department of Defense efforts to improve the total acquisition process of major weapons systems resulted in increased emphasis on prototyping which led to initiation of the Lightweight Fighter (LWF) prototype program in April 1972. As the LWF prototype program progressed, a growing awareness of the operational performance, capability, and cost advantages offered by the YF-16 and YF-17 resulted in the Air Force decision in April 1974 to pursue development of a missionized LWF to be included in the tactical fighter force structure. At the same time, European interest in the LWF as an F-104G replacement in the 1978-1980 time frame offered the additional potential of foreign military sales and increased North Atlantic Treaty Organization (NATO) force effectiveness. The F-16 will help offset the quantitative advantages of threat forces as well as provide the theater commander the flexibility to counter changing tactical situations.

(U) RELATED ACTIVITIES: The following program elements contain development efforts which are applicable to the F-16: Program Element (PE) 27161F, Tactical Air Intercept Missile (AIM-9L/AIM-9M); PE 64602F, Armament/Ordnance Development (Multiple Stores Ejector Rack - MSER); PE 63370F and PE 64314F, Advanced Medium Range Air-to-Air Missile; PE 63249F, Night Attack Program; PE 64201F, Aircraft Avionics Equipment Development (Project 2519, Radar Programmable Signal Processor; and PE 64212, F100 Engine Diagnostic System (EDS). In addition, PE 64268F, Component Improvement Program, funds improvements for the F100 engine which is used in both the F-16 and F-15. Changes from the FY 81 program include addition of the following development efforts which are applicable to the F-16: PE 64737F, Airborne Self Protection Jammer; PE 27423F, Advanced Communication Systems; PE 64754F, Joint Tactical Information Distribution System and PE 64602F, Armament/Ordnance Development.

(U) WORK PERFORMED BY: The F-16 Program Office of the Aeronautical Systems Division, Wright-Patterson Air Force Base, OH, has management responsibility for the F-16 program. The major contractors are General Dynamics, Fort Worth, TX - F-16 airframe; Pratt & Whitney, East Hartford, CT - engine. Major United States subcontractors include Westinghouse, Baltimore, MD - radar; Singer Kearfott, Little Falls, NJ - inertial navigation set; Bendix, South Bend, IN - unified fuel control; Sundstrand Aviation, Rockford, IL - starter and constant speed drive; Delco Electronics, Goleta, CA - fire control computer; Menasco Manufacturing, Fort Worth, TX - landing gear; Hamilton Standard, Windsor Locks, CT - augmentor fuel pump, electronic engine control; and AiResearch Manufacturing, Torrance, CA - flap drive and emergency power unit. In addition to these, there are over 6,400 first tier United States subcontractors. Major European subcontractors include Fabrique Nationale, Belgium - engine; SONACA, Belgium - assembly; FOKKER, The Netherlands - center fuselage and assembly; DISA, Denmark - gear box module and simulator; Konigsberg Vapenfabrikk, Norway - inertial navigation set, fan drive; and Elliott Brothers, England - head-up display. A total of 29 major subcontracts have been placed in Europe.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In January 1975, the General Dynamics YF-16 was selected as the winner of the prototype flyoff between the YF-16 and the Northrop YF-17. Pratt & Whitney was selected as the engine contractor. In November 1975, Westinghouse was selected as the radar contractor after a flyoff competition with Hughes. The first

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Full Scale Development (FSD) aircraft was delivered in December 1976 and the last of the eight FSD aircraft was delivered in June 1978. More than 4,500 test hours have been flown using prototype and preproduction aircraft. The F-16 was approved for full rate production by the Defense Systems Acquisition Review Council in October 1977 and the first production aircraft was delivered in August 1978. Twenty-nine contracts totaling more than \$1.5 billion were signed by the end of FY 1978 when our European co-producers and assembly lines in both Belgium and The Netherlands started producing European aircraft. During 1978, Iran and Israel signed agreements with the United States to purchase 160 and 75 aircraft, respectively; Iran cancelled its order in 1979. Israel, the first Foreign Military Sales customer, received the first of their 75 aircraft in January 1980 for training at a United States site. The first F-16 unit was activated at Hill AFB, UT, and the first F-16 (European co-produced) was delivered to Belgium in 1979. During February through May 1979, the Air Force deployed three full scale development F-16s to Europe for development and operational testing of the aircraft in its intended environment. The results were highly satisfactory. The key problems identified were in radar performance and weapons delivery accuracy. Fixes have been incorporated. For the first two years of operational service the F-16 performed at or above Tactical Air Command standards in sortie utilization rates and reliability and maintainability. The development program continued to concentrate on additional airframe, avionics, and weapons certification testing. Development testing of the Avionics Intermediate Shop was completed in 1980. Initial development was started on a programmable signal processor (PSP) and dual mode transmitter to improve the air-to-air and air-to-surface capabilities of the F-16 and to give it the performance necessary to counter the threat expected in the mid-1980s and beyond. In July 1980, Egypt signed an agreement with the United States to purchase 40 aircraft of which 30 will be diverted from the United States Air Force to be paid back in 1983.

2. (U) FY 1981 Program: FY 1981 RDT&E funds (\$42.7 million) are being used for flight test (\$14.3 million), air vehicle updates (\$1.3 million), stores certification (\$1.6 million), support equipment (\$4.2 million), general management and engineering support (\$4.7 million), and radar improvement efforts (\$16.6 million). The development program will continue to concentrate on additional airframe, avionics, and weapons certification testing. Primary air vehicle update efforts include avionics software improvements, improved handling qualities and resolution of engine icing problem. Additional climatic lab entries and in-flight icing tests will continue in FY 1981 to explore long term improvements to minimize foreign object damage due to ice ingestion. Development of the radar improvements (programmable signal processor and dual mode transmitter) will proceed through critical design review leading to flight testing in early FY 1982. The radar improvements will increase radar detection range, allow multiple target discrimination and indication provide extensive software control of radar signal processing for improved countering of hostile jamming. Extensive operational flight testing will continue through a multinational team composed of representatives of the four European participating countries (Belgium, Denmark, The Netherlands, and Norway) and the United States completing in early FY 1981. Each country is providing aircraft, spares, and personnel. The FY 1981 procurement request funds 180 aircraft and the advanced buy for 96 aircraft in FY 1982. The U.S. production rate will reach 15 aircraft per month, the planned maximum. European assembly lines will be producing six aircraft per month. With the FY 1981 procurement program, the Air Force will be incorporating structural and wiring provisions on the production line F-16 to prepare the aircraft to employ the Advanced Medium Air-to-Air Missile (AMRAAM) and to carry the low altitude navigation targeting infrared night (LANIRN) pod. These systems will significantly improve the airplane's multimission performance by giving it a beyond-visual-range missile capability and an under-the-weather night attack option in the mid-1980s. The major milestones during FY 1981 will be the achievement of combat readiness of the first operational squadron at Hill AFB, UT, (October 1981) and the delivery of the first Air Force F-16s to Korea.

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Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program: The FY 1982 RDT&E funds (\$43.0M) will be used to continue the radar improvement effort (\$20.6M) and initiate flight test of the hardware, to continue air vehicle/engine updates and flight testing including stores certification (\$14.3 million), to initiate F-16/Advanced Medium Range Air-to-Air Missile (AMRAAM) integration and compatibility tests (\$3.0 million), and for management and engineering support (\$5.1 million). The FY 1982 RDT&E request is \$35.0 million greater than that identified in the FY 1981 President's Amended Budget. This increase is the result of added dollars needed to improve the radar (\$20.6M), to accelerate F-16/AMRAAM integration (\$3.0 million), to maintain an F-16 flight test complement at Edwards AFB to continue evaluation of F-16 update/improvement programs (\$6.5 million) and to conduct stores certification (\$1.8 million). Numerous minor programmatic charges account for the balance (\$3.1 million) of the difference. The FY 1982 procurement request funds 96 aircraft and the advanced buy for 96 aircraft in FY 1983. The US production rate will taper to a rate of 8 aircraft per month after the first 650 aircraft are produced. The first 650 aircraft are part of the Memorandum of Understanding the United States has with the European Governments for co-production and industrial participation and are, therefore, "fixed" to a production schedule by contractual agreements. The Air Force is decreasing the follow-on production rate because of funding constraints. Follow-on co-production efforts are being negotiated with The Netherlands for a total of 111 aircraft to be purchased in increments of 22 (FY 1982) and 89 aircraft (outyear) as attrition aircraft and F-5B replacements respectively.
4. (U) FY 1983 Planned Program: FY 1983 RDT&E funds (\$42.0 million) will be used for air vehicle update/management engineering support/flight tests (\$5.5 million); and for radar, weapons updates and weapons certification (\$7.6 million). Efforts will include continuation of F-16/AMRAAM integration (\$12.4 million) and continued radar improvement (\$16.5 million). The planned FY 1983 procurement request will be for 96 aircraft and advance buy 96 aircraft in FY 1984. Under consideration are additional capability improvements for the F-16 to include improved aircraft Group B avionics equipment for growth weapon systems and sensors. Integration funding requirements for these capability improvements will be addressed in the FY 1983 budget request. Maintaining operability with the European partners will be a key consideration in whatever configuration changes are approved. The need for these improvements is based on Air Force analyses of the capabilities the F-16 will require to meet the changing threat in the mid-1980s and beyond.
5. (U) Program to Completion: This is a continuing program. The FY 1984 - 1987 funding (\$66.0 million) will be used to continue integration of the improved radar modes in the F-16; to complete F-16/AMRAAM integration; for flight test of radar, electronic warfare and weapons updates; and continued mission support. The total RDT&E program has grown \$135.4 million between the two budget submissions. Major increases are for increased flight testing/management support (\$17.3 million) for stores certification and improved systems test; improved radar (\$67.0 million); F-16/AMRAAM integration (\$50.4 million); the impact of inflation (\$1.7 million); and other estimate refinement (-\$1.0 million). Delivery of 8 aircraft per month will continue into the early 1990s for a total United States procurement of 1,388 aircraft. The F-16 production program estimate increased from \$17549.9 million to \$20855.0 million because of the following factors: revision of the impact of inflation (+\$559.6 million); adjustment in the cost of purchasing foreign currency (+\$69.7 million); production rate change from 10 aircraft per month to 8 aircraft per month effective FY 1982 (+\$1063.2 million); Group A provisions (structure & wiring for future capability growth changes (+\$133.3 million); improved radar

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(+\$447.7 million); AMRAAM and LANTIRN integration including and improved Fire Control Computer (+\$288.4 million); ASPJ (+\$537.2 million); deletion of MSER funds pending further definition of updated configuration and availability (-\$71.2 million); Re-estimate of flyaway costs (-\$330.2 million); Estimated impact of Egyptian sale (-\$75.7 million); Peculiar Support (AGE, Training, Data) to support capability growth configuration (+\$378.6 million); Avionics Intermediate Shop (AIS) price increase (+\$140.4 million); Repricing of Other Support Equipment (+\$73.8 million); Deletion of requirements for Simulator Full Visual System (-\$331.7 million); Identification of additional Maintenance Training Requirements (+\$52.7 million); Redefined Data Requirements (increased data maintenance due to program stretch) (+\$35.9 million); Revision of Initial Spares (+\$333.4 million).

6. (U) Milestones:

	<u>Date</u>
A. Source Selection/Award Development Contract	Jan 1975
B. Defense Systems Acquisition Review Council (DSARC) II	Mar 1975
C. European Long Lead Funds Released	Jun 1976
D. Delivery First Full Scale Development Aircraft	Dec 1976
E. DSARC IIIA (Long Lead Release)	Jan 1977
F. DSARC IIIB (Production)	Oct 1977
G. First Aircraft to Tactical Air Command	Jan 1979
H. First European Aircraft	Jan 1979
I. Initial Operational Capability (IOC)	Oct 1981
J. Delivery of 651st Aircraft	Sep 1983
K. Delivery of Last F-16 (1,388)	*(Feb 1990) Dec 1991

*Date presented in FY 1981 Descriptive Summary.

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Test and Evaluation Data

1. (U) Development Test and Evaluation: General Dynamics is the prime contractor for airframe and support equipment development and Pratt & Whitney is responsible for continued development of the F100 engine. Most of the major development testing on the basic aircraft, subsystems, and support equipment has been completed. Performance and stability and control testing indicate that the aircraft can meet design specifications and be employed effectively throughout the flight envelope. The F-16 has demonstrated that it can carry and employ a varied mix of weapons including air-to-air ordnance, air-to-surface guided missiles, conventional bombs, and nuclear weapons. The F-16 radar meets basic specifications and can be used effectively to deliver air-to-air and air-to-ground weapons. Ground testing results indicate an airframe life of at least 8,000 hours. As would be expected in any development program, there have been changes required to correct problems identified during the test program. Fixes have been designed, tested, and incorporated into the production aircraft. The last of the development aircraft was delivered in August 1978 and the first F-16 unit was activated at Hill Air Force Base, UT, in January 1979. All weather testing in desert and tropical climates is completed. Alaskan cold weather tests and an evaluation in European weather conditions were completed in early 1979. Testing to evaluate engine inlet icing problems was initiated in Calendar Year 1979 and verified the value of the heated inlet strut. Additional climatic lab entries and in-flight icing tests will continue in Fiscal Year 1981 to explore long term improvements to minimize foreign object damage due to ice ingestion.

(U) Future flight tests will include certification of additional weapons, continued systems integration tests, and evaluation of fixes for previously identified deficiencies. The major test activity in follow-on development will be evaluation of the enhancement of aircraft systems necessitated by threat evolution. Reliability and Maintainability (R&M) testing has been an integral part of the development effort and the F-16 currently indicates it can meet R&M goals established at program approval.

(U) A January 1980 decision by the Air Force to authorize 11 production aircraft for follow-on testing initiated a major effort by Air Force Systems Command to upgrade the F-16 test fleet. Seven aircraft will be assigned to Eglin (Advanced Medium Range Air-to-Air Missile, Low Altitude Navigation Targeting Infrared Night, SEEK EAGLE, and weapons development) and four will be assigned to Air Force Flight Test Center (systems verification and follow-on structures/improvements). Current testing is provided by five (of eight original) full scale development aircraft and the first three test designated production aircraft. F-16A, No. 4, has been decommissioned and will be used as an Air Training Command loading trainer. A second F-16A, No. 6, supports the control configured vehicle Advanced Fighter Technology Integration program. F-16B, No. 2, has been leased to General Dynamics for the F-16/J-79 program. Flight testing of the F-16/J-79 was conducted October-December 1980. Flight testing of the F-16/101 (F-16A, No. 1) Derivative Fighter Engine was initiated in mid-December 1980.

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2. Operational Test and Evaluation:

- a. (U) The initial operational test and evaluation (IOT&E) was conducted in conjunction with the development test and evaluation (DT&E) from December 1976 to October 1977. The IOT&E results, reported in the Air Combat Fighter IOT&E Final Report, January 1978, U.S. Government distribution, supported a production recommendation to the Defense Systems Acquisition Review Council IIIB. Follow-on test and evaluation (FOT&E), Phase I, was completed in January 1979, and reported in the F-16 FOT&E Final Report, Phase I, June 1979, U.S. Government distribution.
- b. (U) The purpose of the operational test and evaluation (OT&E) is to evaluate the operational suitability and effectiveness of the F-16 weapon system. The radar/heads-up display/fire-control system interface was evaluated in air-to-air missions against projected simulated threat aircraft and in air-to-surface attack missions. Air-to-air weapons such as the AIM-9 and M61 gun were fired at realistic maneuvering targets. Day and night evaluation of the F-16 air refueling capability was accomplished. The F-16's performance and handling characteristics were qualitatively and quantitatively evaluated while performing basic fighter maneuvers and air combat maneuvers against current and projected simulated threat aircraft. The electronic countermeasures capability and electromagnetic interference susceptibility of the F-16 were evaluated. In addition, the operational suitability evaluation included: reliability and maintainability to include maintenance support factors, potential maintenance safety hazards, and determination of training requirements and operating and support costs.
- c. (U) The combined DT&E/IOT&E was conducted primarily at Edwards Air Force Base, CA. Other test sites were Nellis Test Range, NV; China Lake, CA; Alaska; El Centro, CA; Yuma, AZ; Panama, CZ; and Eglin AFB, FL. An Air Force Test and Evaluation Center (AFTEC) test team composed of personnel from AFTEC, Tactical Air Command, Air Force Logistics Command, and Air Training Command conducted the OT&E portion of the combined tests. Test resources were incrementally increased to a total of 11 aircraft of which eight were preproduction aircraft and three were production. Additionally, a combined Air Force Systems Command/Air Force Test and Evaluation Center (AFTEC) European Test and Evaluation (ET&E) with three aircraft was conducted from February to May 1979. Test sites included Bodo Air Base, Norway; Skrydstrup Air Base, Denmark; Hahn Air Base, Germany; and Alconbury Air Base, United Kingdom.
- d. (U) Follow-on test and evaluation Phase II was conducted at Hill Air Force Base, UT, and in Europe from January 1979 through December 1980. Tactical Air Command was responsible for operational effectiveness, and Air Force Test and Evaluation Center (AFTEC) further evaluated operational suitability. The AFTEC assessment included reliability/maintainability data generated by all F-16 aircraft assigned to Hill AFB, UT.
- e. (U) F-16 Follow-on Test and Evaluation (FOT&E)/Tactics Development and Evaluation (TD&E) Phase II commenced during January 1979 at Hill AFB, UT. This FOT&E/TD&E was carried out jointly by the Air Forces of Belgium, Denmark, The Netherlands, Norway, and the United States. FOT&E/TD&E Phase II has been designated as the Multinational Operational

Program Element: #27113F (64229F)

DOD Mission Area: Counter Air, #221

Title: F-16 Squadrons

Budget Activity: Tactical Program, #4

Test and Evaluation (MOT&E). The MOT&E consisted of two parts: Part I was accomplished in the United States (Hill AFB) from January 1979 through June 1980, and utilized test facilities and ranges at the following locations: Utah Test and Training Range, UT; White Sands Missile Range, NM; and the Nellis Range Complex in Nevada. Part II was carried out in Europe, from locations within the countries of the European Participating Air Forces (EPAF) between July and December 1980. In both parts of the Multinational Operational Test and Evaluation (MOT&E) program, a mix of USAF and European Participating Air Force (EPAF) production aircraft were used, with a maximum of 10 F-16s used as test assets during Part I. Tactical Air Command was responsible for the operational effectiveness and tactics development objectives, Air Force Test and Evaluation Center (AFTEC) was responsible for the suitability assessment.

f. (U) The purpose of the MOT&E was to refine estimates of F-16 operational effectiveness, assist in evaluation of configuration changes, develop tactics and operating concepts for F-16 employment, and assess the operational suitability of the aircraft. Multinational test team training was accomplished between January 1979 and July 1979.

g. (U) AFTEC flew 467 front seat and 98 back seat sorties during initial operational test and evaluation (IOT&E)/Follow-On Test and Evaluation (FOT&E). This included six months of testing on two near production configured full-scale development aircraft and seven aircraft-months on the first three production aircraft. Operational test and evaluation (OT&E) testing included beyond visual range missions with F-4 and T-38 aircraft; operational comparisons, basic flight maneuvers and air combat maneuvers with F-4E, F-5, A-37, and T-38 aircraft; night and day air-to-surface bombing and strafing; air-to-air gunnery against towed targets; and AIM-9J/L firings against BQM-34, PQM102, and QH-50 drones.

h. (U) Weapons system performance was overall satisfactory. Major operational effectiveness deficiencies by the end of IOT&E/FOT&E and status were as follows:

(1)

pean Test and Evaluation (ET&E) and were satisfactory.

(2)

and are being evaluated during MOT&E.

(3)

during ET&E. An accuracy test program is underway during follow-on full scale development (FSD) and MOT&E.

(4) (U) Poor reliability of jet fuel starter: Satisfactory performance was demonstrated during ET&E, but problems still exist. Extensive changes are in work and will be further evaluated during MOT&E.

Improvements were incorporated during Euro-

Corrections are identified in Engineering Change Proposal 206

Deficiencies were verified

Program Element: #27133F (64229F)

DOD Mission Area: Counter Air, #221

Title: F-16 Squadrons

Budget Activity: Tactical Programs, #4

i. (U) Reliability and Maintainability (R&M) estimates indicated an overall satisfactory rating. The IOT&E/FOT&E assessments for late FSD and production aircraft projected satisfactory mean time between maintenance (MTBMA) and maintenance man-hours per flying hour (MMH/FH) for the mature F-16. Average F-16 MTBMA (for inherent failures) of 0.87 hours compared very favorably with the F-4 and A-7D mature average of 1.0 at the end of FSD. F-16 MMH/FH of 35.7 nearly equalled the mature F-4's 35. Corrective actions to fix major discrepancies affecting R&M goals (i.e., chafing and routing of aircraft wiring, high rate of fuel leaks, and excessive fuel venting due to heat expansion) were incorporated and were satisfactory during ET&E. Damage or loss in flight of nonmetallic panels is no longer a problem due to replacement with metal panels. Concerns remaining at the end of IOT&E/ FOT&E included high could-not-duplicate rates for built-in test/pneumatic, auxiliary power, flight control, and fuel systems; and supportability of the hydrazine emergency power unit. Further evaluation of these areas continued during MOT&E as the F-16 Weapon System matures.

j. During the European Test and Evaluation (ET&E), the F-16 was exercised through a wide variety of realistic operational mission scenarios to provide an early assessment of its effectiveness and suitability when operated in its intended environment. One hundred forty-two sorties were flown for an effective sortie rate of 0.78. This was well above the planned rate of 0.50. As reported in the European Test and Evaluation Final Report Addendum, F-16 Follow-On Test and Evaluation (FOT&E) Phase I, November 1979, U.S. Government distribution overall F-16 performance was highly satisfactory. The aircraft performed exceptionally well during air combat maneuvers, F-15/F-16 composite operations, tactical air-to-surface missions, and conventional nuclear weapon strike, and sea surveillance missions were satisfactory. Radar sea modes performance was excellent during sea surveillance missions.

Taxi, takeoff, and landing on icy surfaces presented no major problems.

k. (U) Operational effectiveness deficiencies noted during ET&E included the following:

(1) (U) Engine icing during ground operations: At near freezing temperature, induction icing occurred when the engine ingested standing water. Although this creates the potential for engine damage, none was observed during the test. Numerous fixes in work include: (a) pilot manual selection of anti-ice; (b) heated intake strut; and (c) additional heat through thirteenth stage compressor inlet guide vanes.

(2) (U) Inadequate lighting for night air refueling: Satisfactory solutions have been identified.

(3) (U) Fuel venting during air refueling: Problem attributed to fuel distribution. Engineering Change Proposal (ECP) 478 incorporates redesign with effectiveness during late Calendar Year 1980-early Calendar Year 1981.

(4) (U) False radar targets: Caused by radar side lobes reflecting off the surface and frequency instability in the main beam. Solutions have been tested, approved, and incorporated.

(5) European test and evaluation software updates provided significant improvement. Further corrections were evaluated during Multinational Operational Test and Evaluations (MOT&E).

Program Element: #27133F (64229F)
DOD Mission Element: Counter Air, #221

Title: F-16 Squadrons
Budget Activity: Tactical Programs, #4

(6)

Software changes

were evaluated by Multinational Test and Evaluation. Progress is evident.

(7)

A pilot selectable fix is in test.

(8)

during follow-on test and evaluation (FOT&E) and verified during European Test and Evaluation (ET&E). Boreighting procedures have been improved; corrected canopy distortion algorithms and slant range corrections have been installed in the fire control computer; and updated weapons separation effects have been included in the storage management computer. Testing has demonstrated that these solutions meet specifications, and fixes are in the field.

Inaccuracies were observed

(9)

This deficiency was identified late in the Follow-on Operational Test and Evaluation (FOT&E) program. Corrections through ECP 206 have been evaluated by MOT&E and determined to be satisfactory.

(10) (U) Fire control/navigation panel difficult to operate by pilot: Fixes have been tested, approved, and planned for production in October 1980.

1. (U) F-16 reliability and maintainability during ET&E was satisfactory to excellent Mean man-hours per flying hour was 17.3. Aircraft flyable rate was excellent at 82 percent. This compares with the end follow-on test and evaluation rate of 54 percent. Problems included low reliability of the radar digital signal processor and low power radio frequency units, and a high rate of nonduplicatable avionics/electrical malfunction indications. A hydrazine spill resulted in equipment improvements. Operations from five different North Atlantic Treaty Organization (NATO) shelter types were satisfactory.

m. (U) Final operational suitability evaluation will be reported by Air Force Test and Evaluation Center (AFTEC) at the close of multinational operational test and evaluation.

3. Systems Characteristics:

Technical Information:

(U) Length (ft)	49.5
(U) Wing Span (w/missiles) (ft)	32.8
(U) Operating Weight (empty) (lbs)	16,126 1/
(U) Internal Fuel (lbs)	6,972
(U) Current Max Takeoff Gross Weight (lbs)	35,400
(U) Max Payload w/Full Internal Fuel (lbs)	12,302
(U) Engine Thrust (lbs)	23,759

1/ Projected Block II weight (aircraft #160).

Program Element: #27133F (64229F)

DOO Mission Area: Counter Air, #221

Title: F-16 Squadrons

Budget Activity: Tactical Programs, #4

Performance Thresholds: (F-16 Development Concept Paper)

Radius - Air Superiority Mission (NM)
Radius - Air-to-Surface Mission (NM) 1/
Sustained Turn Rates
1.2 Mach/30,000 ft (°/sec)
1.2 Mach/30,000 ft (G)
0.9 Mach/30,000 ft (°/sec)
0.9 Mach/30,000 ft (G)
Acceleration Time
0.9-1.6 Mach/30,000 ft (sec)
Max Controllable G
0.8 Mach/40,000 ft (G)
Ferry Range (NM)

1/ Assumes maximum gross weight increased to 35,400 pounds.

Other Characteristics:

(U) Takeoff Distance (Air-to-Air Mission) (ft)
(U) Landing Distance (ft) (estimated)
(U) Mission Reliability (%)
(U) Mean Flight Time Between Failure (hrs)
(C) Radar Detection Range, 2 sq meter Target
(look up/look down)

Threshold

Performance
Demonstrated

N/A
N/A
90
2.90

2200
3300
91
2.20

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element #27162F

Title Tactical Air-to-Ground Missiles
Budget Activity: Tactical Programs, #4

DoD Mission Area: Defense Suppression, #224

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,782	8,082	4,300	TBD	TBD	TBD
2330	High Speed Anti-Radiation Missile (HARM), AGM-88	1,782	8,082	4,300	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The increased sophistication, concentration, and lethality of enemy ground-based, radar guided, missile and anti-aircraft artillery systems threaten the ability of tactical aviation to accomplish its mission and survive. Anti-radiation missiles provide a lethal counter to this threat. The High Speed Anti-Radiation Missile (AGM-88, HARM) is being developed by the Navy to provide a significant upgraded capability against the threat. The F-4G Wild Weasel represents the only lethal defense suppression weapon system in the Air Force inventory. When deployed, HARM will be its primary weapon. This element will find the Air Force unique portions of the Joint Navy/Air Force HARM development program.

BASIS FOR FY 1982 RDT&E REQUEST: Program funding enables completion of Air Force unique development required for IOC and integration of HARM into the F-4G, as well as USAF participation in the joint IOT&E. DSARC III will be held in for this joint Navy/Air Force program.

COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimate Costs
RDT&E	800	8,100	1,700*	300	18,200	
Procurement (Missile) Quantities			145,800 (300)	1,663,800	1,809,600	

* (HARM funding in FY 1982 was deleted because of Department of Defense fiscal constraints.

OTHER APPROPRIATION FUNDS:

Procurement (Missile) (Quantities)	93,100**	TBD	TBD	TBD
	136	TBD	TBD	

**Includes initial spares

Project #2330

Program Element: #27162F

DoD Mission Area: Defense Suppression, #224

Title: AGM-88, HARM (High Speed Anti-Radiation Missile)

Title: Tactical Air to Ground Missiles

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: The HARM is an air-to-surface anti-radiation missile which has been in development by the Navy since 1971. It is an evolution of current Anti-Radiation Missile (ARM) weapons designed to damage or suppress radar-directed air defense systems. Antiradiation missiles currently in the inventory (AGM-45 SHRIKE and AGM-78 STANDARD ARM) are and SHRIKE procurement was terminated in FY 1978. The requirement for an advanced anti-radiation missile (HARM) was identified by the Tactical Air Forces in March 1975. The Air Force has identified HARM as the solution for the near-term portion of this requirement. Missile design goals are: Moderate missile size and weight, high speed (feet per second), high accuracy (ft Circular Error Probable), high sensitivity wideband frequency coverage in a single seeker, long standoff range (up to nautical miles), and the ability to

The HARM, when integrated with the F-4G Wild Weasel, will give the Tactical Air Force a dedicated and highly capable anti-radiation weapons system.

(U) The Air Force, as participating service in the joint Navy/Air Force HARM Program, will fund only those development efforts that are unique to the Air Force. The main thrust of this program will be to integrate the HARM with the F-4G. This integration will require the development and testing of computer software, tests necessary to certify the missile for carriage and launch from the aircraft, and ground and flight tests of the avionics/missile interface. Additionally, peculiar Air Force ground support equipment and technical manuals will be developed.

(U) RELATED ACTIVITIES: The HARM has been designated as the primary Anti-Radiation Missile for the F-4G Wild Weasel. A Memorandum of Agreement of July 1975, between the Air Force and Navy Assistant Secretaries for Research and Development, names the Navy as the Executive Service and the Air Force as the Participating Service in the Joint Service HARM Development Program.

(U) WORK PERFORMED BY: The HARM Development Program is managed by the Navy HARM Program Office, at Naval Air Systems Command Arlington VA, with an Air Force Deputy Program Manager and staff. Management of Air Force unique requirements is provided by the Armament Division Eglin AFB, FL. Principal contractors are: Texas Instruments, Lewisville, TX, McDonnell Douglas Aircraft Corporation, St Louis, MO; Thiokol, Brigham City, UT; and Motorola, Scottsdale, AZ. Government facilities such as the Aeronautical Systems Division, Wright-Patterson, AFB, OH; Naval Weapons Center, China Lake, CA; and the Air Force Flight Test Center, Edwards AFB, CA are also utilized.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Studies and flight testing leading to certification for carriage of the HARM and LAU-118 launcher on the F-4G Wild Weasel began in June 1977. Development of computer software to integrate the HARM with the F-4G APR-38 avionics began in 1978. A Defense System Acquisition Review Council IIA was held on 14 Feb 1978. On 23 March 1978 the Secretary of Defense approved HARM's entry into engineering development. Modifications to the F-4G to integrate the HARM have been developed, bench tested, and flown in a series of live firings and captive flight missions. Computer software, developed to integrate HARM with the APR-38, have been bench/ground tested and evaluated in captive flight tests and HARM firings from the F-4G. A total of HARM Development Test and Engineering Phase firings have been completed, eight from the Air Force F-4G and ten from the Navy A-7F aircraft. This completed Development Test and Engineering HARM firings as of Oct 1980.

Project: #2330

Program Element: #27162F

DoD Mission Area: Defense Suppression, #224

Title: AGM-88, HARM

Title: Tactical Air to Ground Missiles

Budget Activity: Tactical Programs, #4

The -

taken. The -
testing, the missile

missile will be made to lessen the effects of these special conditions.
specific components, and corrective action
Occasionally, during captive flight
of RF homing systems, but refinements of the HARM

2. FY 1981 Program: Qualification testing of a HARM/APR-38 software threat update will be completed. Integration of HARM into the F-4G will continue, to include development and testing of Air Force peculiar ground support equipment and technical data. Prior to the Initial Operational Test and Evaluation phase, the Program Management Activity is developing

This test effort includes 16 captive carry missiles (8 Navy and 8 Air Force); and 24 missile firings (12 for Navy and 12 Air Force). A Department of the Navy Systems Acquisition Review Council (DNSARC) IIB approved Navy FY 1981 pilot production of missiles. The Assistant Secretary of Defense reviewed this milestone decision and certified the missiles' maturity for the pilot production.

3. FY 1982 Planned Program: The planned Air Force Initial Operational Test and Evaluation, and testing of Air Force peculiar ground support equipment and technical data will be completed. A Joint Navy/Air Force Defense Systems Acquisition Review Council Milestone III is planned for April 1982 for a full scale production decision. The Air Force plans to procure 136 HARM missiles in FY 1982.

4. FY 1983 Planned Program: The Air Force will conduct a Follow-on Test and Evaluation to insure that any latest test issues that could arise in Initial Operational Test and Evaluation are incorporated and evaluated. Initial deliveries to Air Force inventory begin in

5. Program to Completion: Air Force achieves a HARM Initial Operating Capability in

6. Milestones:

a. DSARC I	Date	Oct 1972
b. DSARC II A		Jan 1977
c. DSARC II A (additionally)		Feb 1978
d. DNSARC II B		Nov 1980
e. Begin IOT&E		Jul 1981
f. DSARC III		
g. Air Force deliveries begin		
h. Air Force Initial Operating Capability		

*Date presented in Fiscal Year 1981 Descriptive Summaries.

Project: #2330

Program Element: #27162F

DoD Mission Area: Defense Suppression, #224

Explanation of Milestone Changes:

Title: AGM-88, HARM (High Speed Anti-Radiation Missile)

Title: Tactical Air to Ground Missiles

Budget Activity: Tactical Programs, #4

Budget Activity: Tactical Program, #4

Program Element: #27162F Tactical Air-to-Ground Missiles

Test and Evaluation Data

1. (U) Development Test and Evaluation (DT&E): The AGM-88 High Speed Anti-radiation Missile (HARM) is a joint Navy/Air Force project with the Navy as Executive Service. The Navy conducted Engineering Development under Program Element 64360N. Naval Weapons Center, China Lake was the lead organization. Texas Instruments was chosen as the Weapons System Integration Contractor. The Air Force monitored the Navy Development Test and Evaluation and also conducted seven of the fourteen live firings. Air Force Development Test and Evaluation addressed the integration of the High Speed Anti-radiation Missile with the F-4G Wild Weasel, which contains the APR-38 avionics suite. Since 1977, modification to the F-4G to integrate the High Speed Anti Radiation Missile have been developed, bench tested, and flown in a series of captive flight missions. Computer software, developed to integrate High Speed Anti-radiation Missile with the APR-38 have been bench/ground tested; and evaluated in captive flight tests and High Speed Anti-radiation Missile firings from the F-4G.

Prototype missiles and pilot production missiles are being procured during Development Test and Evaluation. Prototype and pilot production hardware will contain High Speed Anti-radiation Missile capabilities which were developed during the extended phase of advanced development. Test results are shown in Navy Program Element 64360N Descriptive Summary.

Prototype Missiles - These missiles are being tested to evaluate performance of the contractor prototype design against a variety of radar targets in five operational scenarios. Prototype hardware will be subjected to ground tests, captive flight tests and firing tests. Objectives include: acquisition and tracking of characteristic target signatures in various operational scenarios, and verification of hazard free performance to aircraft and handling personnel. An indication of operational effectiveness and suitability will be obtained. As of October 80, a total of missiles out of an missile firing programs had been fired from the Navy A-7E and Air Force F-4G to demonstrate against a variety of radar targets. All but successful and all test objectives have been met to date. The firing program was interrupted seven months and also a problem. Solutions have been incorporated; but these problems have slipped Defense Systems Acquisition Review Council III about six months. The missile system is now more representative of the production configuration; with seeker heads having with microwave circuit board and with built in-test provisions incorporated. The Program Management Activity is implementing additional fixes prior to Initial Operational Test and Evaluation to include

During this phase, reliability was evaluated through a test, analyze and fix program, and reliability growth is expected to exceed the by Defense Systems Acquisition Review Council III, as planned. A preliminary maintainability demonstration was held using operational personnel. A Department of the Navy Systems Acquisition Review Council II B held in Nov 1980 evaluated test results of completed prototype missile firings and approved proceeding to pilot production in FY 1981.

Pilot Production Missile - Pilot production missiles were utilized to conduct and complete Development Test and Evaluation and will be utilized to conduct the Joint Initial Operational Test and Evaluation. Initial Operational Test and Evaluation is planned for and includes 45 missiles to be allocated as follows for testing. Twenty-five are for Navy testing (five for Navy Technical Evaluation and twelve for Navy Operational Evaluations test firings). Twenty missiles are for Air Force testing (to include twelve for Initial Operational test and Evaluation test firings). Pilot production and related equipment will be evaluated against full specification, operational suitability requirements to certify readiness of the system to enter operational evaluation. Missile reliability will be demonstrated and a first article configuration inspection will be accomplished to validate the contractor's competitive production data package.

2. (U) Operational Test and Evaluation: Operational Testing on the High Speed Anti-radiation Missile built by Texas Instruments, Lewisville, Texas will be conducted as a joint Navy Operational Evaluation Air Force Initial Operational and Evaluation program. Each service will separately evaluate the missile with its own aircraft and avionics but will coordinate planning and share test results to eliminate duplication of effort. The purpose of the Initial Operational Test and Evaluation is to evaluate the operational effectiveness and operational suitability of the High Speed Anti-Radiation Missile to provide a basis for the first major production decision.

(U) The Initial Operational Test and Evaluation, which will be managed by the Air Force Test and Evaluation Center will be conducted in two phases, a preliminary phase and a dedicated phase. An Air Force Preliminary Evaluation was conducted (January 1979 - October 1980) in combination with Development Test and Evaluation, using prototype missiles to obtain an early indication of operational effectiveness and suitability. During Development Test and Evaluation eight missiles were fired from the F-4G Wild Weasel aircraft by operational aircrews from the Tactical Air Command, to provide data for the Air Force Preliminary Evaluation Navy and Air Force maintenance personnel monitored missile buildup, test, repair, and maintenance actions by the contractor.

The following table provides a breakdown of the eight firings. Since several objectives are included in each shot, the columns are not additive.

OBJECTIVE	ATTEMPTS	LAUNCH	SUCCESS	FAILURE	PERCENT SUCCESS	MISSION NUMBER
Cartimore Wave Target						GM205
Post launch turn						GM205/210/215/218
J-Band target						GM212/218/215
Supersonic/transonic						GM212/217/214
Flex Logic						GM212/214
Rotating Target						GM210/217
High Acceleration						GM214
Sidelobes (90 degrees)						GM201

(U) The dedicated phase of Air Force Initial Operational Test and Evaluation planned for (July-December 1981) will be conducted separate from development testing, and will use pilot production missiles integrated with production F-4G aircraft. In addition to a captive-flight program to evaluate reliability of the missile, a minimum of 12 pilot production missiles will be fired from the F-4G. Testing will be conducted on test ranges at Nellis Air Force Base, Nevada; Point Mugu Missile Test Center, California; China Lake, California; and White Sands Missile Range, New Mexico. Tactical Air Command operational aircrews will fly these missions and missile maintenance checkout and loading will be performed by Air Force personnel. The reliability criteria for this phase of testing in mean flight hours before failure are a threshold of 105 hours, a standard of 130 hours, and a goal of 150 hours.

3. System Characteristics:

CHARACTERISTICS	MILESTONE II B THRESHOLD	MILESTONE III THRESHOLD	MILESTONE III GOAL *	DEMONSTRATED
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Range:

(Level Launch) Nautical Miles

- 5,000 Foot Altitude
- 15,000 Foot Altitude
- 30,000 Foot Altitude

Accuracy:

Circular Error Probable
(in Feet)

Frequency Coverage:

- (Gigahertz)
- Pulse
- Continuous Wave

Technical:

Length (Feet)

Diameter (Inches)

Weight (Pounds)

Velocity (Average over
10 Nautical Miles)
(Feet per Second)

Free Flight Reliability:

* DCP-93 Goals - (Revision A in process)

** Includes Air Force and Navy firings through 17 August 1980

*** Demonstration based on results of Development Test and Evaluation of contractor missiles extrapolated to specific performance parameters. Approved program operational and technical characteristics will be demonstrated during operational evaluation (Navy Operational Evaluation/Air Force Initial Operational Test and Evaluation).

**** Results to date continue to support the approved program goals.

(1030)

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27247F

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: Tactical Surveillance System
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	300	300	300	300	Continuing	Not Applicable

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program has as its main objective the development of procedures, tactics, and interface equipment/software to facilitate operational framework.

(U) BASIS FOR FY 1982 RDT&E REQUEST: In 1977 Congress directed each service to establish a Service Tactical Surveillance office to direct related studies and exercises. The FY 1981 funding and outyear programming provide continuing funding for this effort. Efforts will include evaluation and development of interfaces with national programs and enhancement of our tactically deployed forces through tactical exercises and improved interfaces with the Intelligence Community. This will include necessary software development, equipment evaluation, and related developmental studies. The FY 1982 cost estimates for these activities are based on the FY 1980 completed activities and projections for continuity into FY 1982.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	300	300	300		Continuing	Not Applicable
<u>OTHER APPROPRIATION FUNDS:</u>						
Operations and Maintenance	2,000	3,000	3,100		Continuing	Not Applicable

Note: The Operations and Maintenance funds are used to conduct essential tactical exercise interfaces.

Program Element: #27247F

DoD Mission Area: Tactical Surveillance, Reconnaissance
and Target Acquisition, #255

Title: Tactical Surveillance System
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: This program was established by Congress to explore the tactical utility of and testing of tactics utilizing efforts accomplished under this program will provide for development, evaluation, exercises, system interface software/hardware development, and related developmental studies.

(U) RELATED ACTIVITIES: Will require interface with national systems.

(U) WORK PERFORMED BY: Air Force management of this effort will be under the Air Force Deputy Chief of Staff for Plans and Operations. The principal contractor is the Aerospace Corporation, El Segundo, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This information is available at higher security levels and a complete view of the program is available in the FY 1982 Intelligence Related Activities, Congressional Justification Book.
2. (U) FY 1981 Program: This effort will continue exercise evaluation, software development programs and equipment and procedure evaluation.
3. (U) FY 1982 Planned Program: On-going FY 1981 efforts will be continued. Efforts will be initiated for interface with various Air Force, other service and national programs to include studies, software modification and equipment evaluation. A continued involvement in tactical exercises will be pursued.
4. (U) FY 1983 Planned Program: On-going efforts will continue.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 27411

Title: Overseas Air Weapons Control Systems
DOD Mission Area: Tactical Command and Control, #254
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
2264	TOTAL FOR PROGRAM ELEMENT EIFEL/DISTEL I	1,000 ¹ 575 ¹	200 200	2,300 200	2,200 100	Continuing Continuing	Applicable Not Applicable
2704	EIFEL/II	425 ¹	0	2,100	2,100	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Under Project 2644, EIFEL/DISTEL I, the United States Air Force will adapt and procure the German-developed EIFEL/DISTEL I system, an automated command and control system, for the United States Air Force operated Allied Tactical Operations Center at Sembach, Germany. Under Project 2704, EIFEL II, the United States Air Force will cooperate with the Federal Republic of Germany in the development of a follow-on system to replace EIFEL/DISTEL I.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Air Force Systems Command has been tasked to provide technical assistance to United States Air Forces Europe to acquire the EIFEL/DISTEL I system. Initial operating capability for EIFEL/DISTEL I is planned for March 1982. Air Force Systems Command has also been tasked to monitor the German EIFEL II effort, work with United States Air Forces Europe in developing requirements and provide recommendations as to the degree of United States participation in EIFEL II. The validity of the FY 1982 cost estimate will depend on the degree of United States participation in EIFEL II. A recommendation for more US involvement in EIFEL II will require additional funds.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Procurement (Other)	0	200	200	300	Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other) (Quantity)	0	12,500	300	Continuing	Not Applicable

1 Funds programmed in Program Element (PE) 27415, United States Air Forces Europe Command and Control Systems, for early work in developing specifications, documentation, and a Memorandum of Understanding, and study activities for EIFEL II.

Program Element: # 27411

DOD Mission Area: Tactical Command and Control, #254

Title: Overseas Air Weapons Control System
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: EIFEL/DISTEL is a German-developed data management and command and control system which automates selected command and control functions. The system has been installed in the two North Atlantic Treaty Organization (NATO) Central Region Allied Tactical Operations Centers (ATOC) operated by the Federal Republic of Germany. The United States Air Force (USAF) plans to adapt and procure the present version of EIFEL/DISTEL for installation in the US-operated Central Region ATOC at Sembach, Germany. By procuring the EIFEL/DISTEL I system, the four ATOCs in the NATO Central Region will have common equipment. This procurement will significantly enhance interoperability. This program, then, is a prime example of NATO-stated objectives for commonality/interoperability and furthers the administration's "two-way street" policy regarding NATO procurements. The United States Air Force has agreed to cooperate with the Germans in a follow-on capability to the EIFEL/DISTEL I System, known as EIFEL II.

(U) RELATED ACTIVITIES: A Memorandum of Understanding on EIFEL/DISTEL I has been negotiated and is ready for signature by US and German representatives. A Memorandum of Understanding is being developed to cover early study activities and information exchange between the two countries on EIFEL II.

(U) WORK PERFORMED BY: United States Air Forces Europe (USAFE), Ramstein Air Base, Germany will manage the acquisition of the EIFEL/DISTEL I System with technical assistance provided by Air Force Systems Command. Hardware and software will be acquired for the United States by the Federal Republic of Germany from the German Siemens Corp. The EIFEL II effort is being accomplished by the Air Force Systems Command. Mitre Corp will provide contractual support in this effort.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The initial feasibility studies were completed and the Memorandum of Understanding has been negotiated. In addition, plans have been developed to adapt the EIFEL/DISTEL I System to meet the unique requirements of the ATOC at Sembach, Germany. Negotiations to procure the German-developed hardware and software have begun. Study activities and document translations accomplished on EIFEL II.
2. (U) FY 1981 Planned Program: Procure and install the EIFEL/DISTEL I System. Requirements definition on EIFEL II.
3. (U) FY 1982 Planned Program: Complete installation and testing the EIFEL/DISTEL I System. EIFEL II development activities begin. The increase in cost estimate over the FY 1981 Descriptive Summary is due to the addition of the EIFEL II effort.
4. (U) FY 1983 Planned Program: Maintenance and minor modifications of the EIFEL/DISTEL I System. EIFEL II development activities continue.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable

Program Element: # 27411

DOD Mission Area: Tactical Command and Control, #254

Title: Overseas Air Weapons Control System
Budget Activity: Tactical Programs, #4

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
RDT&E	1,000	200	2,300	2,200		
Procurement (3080)	0	12,500		300		

8. (U) Comparison with FY 1981 Budget Data: RDT&E funding estimates for FY 1982 increased over those included in FY 1981 Budget Data due to addition of the EIFEL II effort. Procurement funds in FY 1982 have been deleted as unnecessary.

1 Funds programmed in Program Element 27415, United States Air Forces Europe Command and Control Systems.

FY 1981 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 27412F

Title: Tactical Air Control System (TACS)
Budget Activity: Tactical Programs, #4

DOD Mission Area: Tactical Command and Control, #254

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	10,101	12,400	1,200	0	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical air forces require a highly developed, reliable, positive control system to fully exploit the inherent capabilities of tactical air power. The Tactical Air Control System (TACS) provides the means through which the Air Force Component Commander exercises control of his forces to accomplish his assigned mission. This program provides for major improvement to the existing manual TACS. Efforts in progress are designed to automate command, control, and communications processing functions; to develop electronic countermeasures; and to develop the System Trainer and Exercise Module (STEM) for Control and Reporting Center/Control and Reporting Post (CRC/CRP) personnel.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request provides for procurement of the STEM and for continued development and procurement of the Ultra Low Sidelobe Antenna (ULSA). Budget estimates are based on current contract values.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	10,900	12,500	6,800	7,600	Continuing	Not Applicable
Procurement (Other)	0	17,900	34,951	39,900		

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)	0	17,800	8,900	17,700	Continuing	Not Applicable
(Quantity) STEM		(8)	(7)			
ULSA		(5)		(22)		

(1037)

Program Element: # 27412F

Title: Tactical Air Control System (TACS)
DOD Mission Area: Tactical Command and Control, #254
Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The 485L development and acquisition program is established to provide effective improvements to the Tactical Air Control System (TACS). The TACS consists of the men, materiel and procedures established to control tactical air operations. The tactical air forces require a highly developed, reliable and systemized positive control system to fully exploit the inherent flexibility of tactical air power.

(U) Improvements to the TACS are evolutionary and are implemented through a series of procurements designed to increase system effectiveness incrementally while responding to the increasing enemy threat. The first of three phases, approximately 1965-1968, was an expedited buy of "off-the-shelf" equipment to provide a first-level capability for urgent, near-term contingency requirements. The second phase, approximately 1969-1972, provided improved equipment with state-of-the-art technology. Phases I and II were accomplished under the 407L Program. The third phase, approximately 1973-1984, provides automated and miniaturized equipments. Equipment to satisfy the capabilities required in Phase III is being developed and acquired under the 485L Program.

(U) Those improvements presently planned for development and acquisition are listed below:

- (1) Netted Telephone Radio Interface Device
- (2) System Trainer and Exercise Module
- (3) Dual Band Radar Beacon AN/TPN-28
- (4) Ultra Low Sidelobe Antenna
- (5) Anti-Radiation Missile Alarm Sensor
- (6) Modular Control Element
- (7) Computer Assisted Force Management System

(1038)

Program Element: #27412F

DoD Mission Area: Tactical Command and Control, #254

Title: Tactical Air Control System (TACS)

Budget Activity: Tactical Program, #4

(U) RELATED ACTIVITIES: This program interfaces with the Tactical Information Processing Interpretation Program, the Joint Interoperability of Tactical Command and Control Systems Program, and with efforts to improve European and Korean Command and Control Systems.

(U) WORK PERFORMED BY: Electronics Systems Division, Hanscom Air Force Base, MA, is responsible for this program. Rome Air Development Center, Griffiss AFB, NY, and the Tactical Air Command, Langley Air Force Base, VA, provide engineering and operational support. Major contractors include GTE Sylvia, Needham Heights, MA (System Trainer and Exercise Module) (STEM); Applied Devices Corp, Long Island, NY (Dual Band Beacon); and MITRE Corp., Bedford, MA, (Systems Engineering).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In 1980, all 20 Frequency Shift Keyers were delivered. Development and in-plant testing continued for the System Trainer and Exercise Module (STEM). The contract for full scale development for the Ultra Low Sidelobe Antenna (ULSA) was awarded to Westinghouse. The Request for Proposal for Anti-Radiation Missile (ARM) Alarm was completed. The Dual Band Beacon failed Initial Operational Test and Evaluation. AFSC and TAC plan actions to clear the discrepancies and re-test before a production decision is made. The Air Force continued to receive production models of the AN/PRC-104, Lightweight Manpack Radios, and the S-530, Electrical Equipment Shelters. In 1979, the Air Force accepted delivery of all 22 AN/GSQ-120, Microwave Relay Sets.
2. (U) FY 1981 Program: Complete STEM development. Plan support for the Computer Assisted Force Management System (CAFMS). Continue development of ULSA and ARM Alarm.
3. (U) FY 1982 Planned Program: Procure STEM. Complete engineering development of ULSA. The program has been reduced in scope because of a reduction in budget resources necessitated by higher priority Air Force requirements.
4. (U) FY 1983 Planned Program: Procure ULSA and ARM Alarm.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable

1039

1040B

1039
1040B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27417F(64744F)

Title: Tactical Airborne Command and Control System
DoD Mission Area: Tactical Command and Control, #254
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	41,224	63,000	53,800	63,600	38,600	1,596,624

NOTE: RDT&E funds for FY 1978 and prior were included in PE 64744F, Airborne Warning and Control System. Large aircraft terminal development for the Joint Tactical Information Distribution System (PE 64754F) is funded in PE 27417F.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program has as its main purpose the development and acquisition of an effective survivable airborne surveillance system for command and control of tactical forces and strategic defense of the United States. The E-3A Airborne Warning and Control System will overcome ground based surveillance system deficiencies through its unique ability to provide extended all altitude surveillance and for the first time, the means to manage an air battle situation in real time. It will contribute significantly to a more effective integration of the capabilities of United States forces supporting United States, North Atlantic Treaty Organization or other worldwide requirements.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request will continue full scale development of additional radios, multipurpose consoles, and command consoles as well as initiating full scale development of ECCM improvements. Estimates are based on program office engineering and financial analysis of planned efforts for development and estimates of required support from other agencies.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional To Completion	Total Estimated Costs
RDT&E Procurement (Aircraft)	<u>52,100</u> 326,800	<u>65,600</u> 260,600	<u>64,100</u> 241,800	<u>76,100</u> 183,700	<u>36,800</u>	<u>1,631,300</u> 2,736,100

(U) OTHER APPROPRIATION FUNDS:

Procurement (Aircraft) (Quantity)	327,200 (3)	272,000 (2)	0 (0)	552,800 (4)		2,857,500 (31)
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Program Element: #27417F(64744F)

DoD Mission Area: Tactical Command and Control, #254

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The E-3A Airborne Warning and Control System will support a variety of tactical air operations and the air defense of the Continental United States. It will overcome current deficiencies of present ground based systems (range, vulnerability, limited effectiveness against low altitude targets and susceptibility to electronic countermeasures). The capability to detect and track targets against ground clutter makes the E-3A effective against low-altitude targets. Since the radar is mounted on a high flying jet aircraft, increased surveillance volume and detection range are realized. Mobility, coupled with the awareness of potential threats, and the ability to command weapons in its own defense make the E-3A highly survivable.

The airborne platform is a Boeing 707 aircraft equipped with radar, communications, identification sensors, navigation units and data processor to provide an integrated presentation of the air situation on operator display consoles. Software changes in the central processor configure the E-3A for tactical or strategic defense missions. The Core E-3A is capable of detecting and tracking low flying aircraft targets in the presence of ground clutter, detecting bomber aircraft at a distance of nautical miles, detecting tactical aircraft up to nautical miles, computer tracking of targets, 6.2 hours on station time at 1000 nautical miles from base, and active interrogation of aircraft using a cooperative beacon in cryptological secure or standard modes. Increased Command and Control improvements as well as electronic counter-countermeasures improvements are planned for the E-3A to exploit its inherent capabilities and to keep pace with the evolving threat.

(U) The E-3A significantly enhances the combat effectiveness of air, ground and naval forces. Strategic defensive forces will utilize the E-3A, in conjunction with interceptor forces, for the wartime defense of the Continental United States and as an integral element of the mobile air defense force for contingencies requiring air defense outside the United States. Tactical forces will use the E-3A for command and control during the deployment of tactical air forces; and in accomplishing interdiction, rescue and airlift missions. Its flexibility and versatility will enable it to be deployed at any level of military action ranging from a show of force through general war. During these deployments, the means will exist, for the first time, to manage the air and sea battle.

(U) RELATED ACTIVITIES: The Overland Radar Technology Program (Program Element 63701F) proved the feasibility of overland radar in support of an airborne warning and control system. The conceptual portion of the E-3A program was funded under Program Element 63402F prior to December 1967. The North Atlantic Treaty Organization Airborne Early Warning and Control System (Program Element 64752F) was established in FY 1978 to fund United States share of the North Atlantic Treaty Organization development effort (subsequently changed to Program Element 01012F).

(U) WORK PERFORMED BY: The Air Force management is provided by the Electronic Systems Division, Hanscom AFB, Bedford, Massachusetts. The integration contractor is Boeing Aerospace Company, Seattle, Washington. The major subcontractors are: (1) Radar - Westinghouse Electric Corporation, Baltimore, Maryland; (2) Data Processor - International Business Machines, Owego, New York; (3) Displays - Hazeltine Corporation, Long Island, New York; (4) Ultra High Frequency radios (less transceivers) - Electronics Communications Incorporated, Saint Petersburg, Florida; (5) Identification Friend or Foe - Airborne Instruments Laboratory, Long Island, New York; (6) Navigation - Northrop, Los Angeles, California; (7)

Program Element: #27417F(64744F)

DoD Mission Area: Tactical Command and Control, #254

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

Very High Frequency radios - Collins Communications Systems, Cedar Rapids, Iowa; (8) Audio Distribution System - Hughes Aircraft Company, El Segundo, California; and (9) Joint Tactical Information Distribution System Digital Data Link - Hughes Aircraft Company, Fullerton, California. Government Furnished Equipment vendors are: (1) Engines - Pratt and Whitney Aircraft Division of United Aircraft Corporation, Hartford, Connecticut; (2) Ultra High Frequency Transceivers - Collins Communications Systems, Cedar Rapids, Iowa.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior accomplishments: Feasibility studies by Boeing, McDonnell Douglas, and Lockheed (each study using a different radar and airframe) led to the Air Force conclusion that an Airborne Warning and Control System was feasible and could be delivered in the 1970s. In FY 1967, contracts were awarded to Boeing and McDonnell Douglas for studies to examine the aerodynamics of the radar rotodome configuration, to determine the optimum configuration and to integrate the results of studies conducted under the Overland Radar Technology Program into a system study to establish a baseline design. The Contract Definition Phase of the program was initiated during CY 1969 and was completed with the selection of the Boeing Company as the system acquisition contractor in July 1970. The airborne warning and control system program and the contract with Boeing was arranged in three phases (Brassboard Radar Demonstration; Development, Test and Evaluation; and Production) with established performance milestones within each phase that were demonstrated with test results before the decision was made to proceed to the next phase.

(U) The Brassboard Radar Demonstration phase, initiated with Hughes and Westinghouse as competing radar subcontractors, was designed to verify the performance of the radars. The two radars (Hughes and Westinghouse) were installed in modified Boeing 707 aircraft and the competitive radar fly-off began in March 1972. The airborne warning and control system long lead avionics subsystem development to support the development, test and evaluation phase was initiated following successful ground testing of the radars.

(U) The competitive radar flight test programs was successfully completed in October 1972 with the selection of Westinghouse as the radar vendor. The Airborne Tracking Demonstration was initiated and accomplished early due to the early announcement of the winning radar vendor. After the successful completion of the Brassboard Radar demonstration phase in December 1972, the development, test and evaluation phase which included the System Integration Demonstration was initiated with utilization of the selected radar and other mission avionics to demonstrate the total airborne warning and control system function. The system integration demonstration avionics configuration, originally a single-thread system to resolve technical problems prior to a production request, was enhanced by the inclusion of additional equipment to permit the using commands, Tactical Air Command and Aerospace Defense Command, to conduct a parallel Initial Operational Test and Evaluation. This permitted the production decision to be supported by both technical feasibility and operational suitability data. In FY 1973, the brassboard aircraft, used to test the non-selected radar, was upgraded to the Development Test and Evaluation prototype configuration for use as the first test aircraft. Additionally, the fabrication of two new test aircraft was started at this time.

Program Element: #27417F(64744F)

DoD Mission Area: Tactical Command and Control, #254

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs #4

(U) In FY 1974 the installation and checkout of the hardware and software in the System Integration Demonstration aircraft was completed and the first flight was accomplished in March 1974. The remainder of the FY 1974 system integration demonstration efforts were devoted to performance verification of subsystems as well as the fully integrated system configuration including both air vehicle and mission electronics. All critical design reviews for the fully configured E-3A Airborne Warning and Control System were completed. Initial equipment deliveries for the development, test and evaluation Avionics Integration Laboratory were received and installation was begun. Work continued on the three test aircraft initially funded in FY 1973.

(U) The systems integration demonstration flight test program, with active participation by the operating commands, was completed in November 1974. This, and other test flights during FY 1975, demonstrated the operational suitability of the E-3A while evaluating electronic compatibility/interference with other systems, survivability, interoperability/mutual enhancement with other Army, Air Force and Navy command/control and weapons systems and performance in electronic counter-measure environments. The results provided high visibility into the potential of the E-3A and confidence for the production release in March 1975.

(U) In addition to the systems integration demonstration tests, fabrication continued on the three operationally configured pre-production test aircraft with research and developments funds. Development of Time Division Multiple Access communications terminals and installation design were also started. A maritime surface surveillance modification to the radar was accomplished in support of demonstration goals for the April 1975 Deployment. Flight crew training of Air Force personnel was initiated. Full scale production of the six E-3As authorized in FY 1975 began in March 1975. The first operational delivery occurred in March 1977.

(U) By December 1975, all of the mission avionics had been installed, checked out and integrated in the Avionics Integration Laboratory. Airworthiness flight tests to determine air vehicle flight loads, flutter characteristics and performance handling qualities began in August 1975 with the first test aircraft and were completed in October 1976. The second test aircraft with mission avionics equipment began flight tests in October 1975. The third test aircraft began flight tests in May 1976. These three aircraft and production system #1, which began flight tests in July 1976, were utilized to accomplish the objectives of the Core, or basic, configuration test program. Separate development, test and evaluation/initial operational test and evaluation test programs will be accomplished on enhancements to this Core configuration. These aircraft will be delivered to the operational force.

(U) The Development, Test and Evaluation on the Core configuration was completed in January 1977. This reflected a seven month compression over the previously planned test program made possible through utilization of data previously obtained, principally during the extensive testing conducted during FY 1975. Emphasis continued to be placed on using Air Force personnel to man the operating positions to validate the human factors aspects. Concurrent testing of navigation and communication subsystems, software and flight essential avionics qualification were conducted during radar performance/total system evaluation.

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Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

(U) Three operational evaluations of the E-3A were conducted. Two E-3As participated in each of three exercises; a joint Army-Air Force readiness exercise, a tactical exercise representative of the threat and magnitude of a European conflict, and a Continental United States air defense exercise. The E-3A underwent all-weather testing in the climatic hangar, and a reliability/maintainability demonstration.

(U) Development efforts continued on Time Division Multiple Access communications and Maritime Surface Surveillance enhancements with their associated software. These enhancements will increase the capability and flexibility of the Airborne Warning and Control System in its worldwide surveillance and control functions. Time Division Multiple Access communications, embodied in the Joint Tactical Information Distribution System, provides for jam-resistant high capacity information flow. The Maritime enhancement permits improved surveillance of ocean areas. The Avionics Integration Laboratory which has the same configuration as the production aircraft, continued to be used to evaluate complex operational and engineering situations that cannot be easily generated in flight testing.

(U) The approval, in December 1978, of a North Atlantic Treaty Organization Airborne Early Warning and Control program of 18 E-3A aircraft was based on a United States/North Atlantic Treaty Organization standard configuration that would meet North Atlantic Treaty Organization operational requirements. This standard configuration uses the United States developed Maritime radar and Joint Tactical Information Distribution System as a baseline and adds a large computer for increased track capacity and an HF radio and teletype capability developed by the North Atlantic Treaty Organization. During FY 1979, the Maritime and Joint Tactical Information Distribution hardware and software development efforts and testing were merged into a standard configuration development plan. The Standard Configuration has been approved for production on the United States E-3As starting in FY 1980 on an interleaved production line with North Atlantic Treaty Organization aircraft Initial operational test and evaluation of the standard configuration will start in April 1981.

(U) During FY 1980, in addition to continuing the integrated development of the standard configuration, initial efforts began to correct deficiencies identified during initial operational testing. To correct these deficiencies, increased command and control capabilities are being added to fully realize the capabilities of the E-3A system. Also studies were begun to define the most cost effective electronic counter-countermeasures to incorporate into the E-3A to assure continued resistivity to the evolving threat environment.

2. (U) FY 1981 Program: Flight testing of the United States/North Atlantic Treaty Organization standard configuration with maritime radar and Hughes Improved Joint Tactical Information Distribution System terminal and a larger computer will be conducted. Full scale development will start to integrate additional ultra high frequency radios, multipurpose consoles and a command console into the E-3A. This expanded command and control equipment will increase operational flexibility and capability. Initial development will begin to incorporate new technologies into the E-3A radar needed to ensure its resistivity to the evolving electronic countermeasures threat. Changes in RDT&E are related to delays in Electronic Counter-Countermeasures improvements, originally planned to start in FY 1979 which are now planned to start in FY 1981. This delay was necessary to evaluate new technology that will ensure resistivity of the E-3A radar to electronic countermeasures in the projected threat environment. Electronic counter-countermeasures studies and brassboard

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Title: Tactical Airborne Command and Control System

Budget Activity: Tactical Programs, #4

engineering designs are underway to evaluate the most promising technologies.

3. (U) FY 1982 Planned Program: The United States/North Atlantic Treaty Organization Standard Configuration Initial Operational Test and Evaluation testing will be completed. Development will continue on additional radios, additional multipurpose consoles, a command console and electronic counter-countermeasures improvements. Changes in the E-3A production program reflect directed deferral of programmed FY 82 aircraft to FY 83. This restructuring was required due to constrained funds and will result in a break in production for United States E-3A aircraft.

4. (U) FY 1983 Planned Program: Flight testing starts for expanded command and control configuration. Full scale development of electronic counter-countermeasures continue.

5. (U) Program to Completion: Development of enhancements continues with completion in FY 1984.

6. (U) Milestones:

- A. Engineering Development Contract Award
- B. First Flight (Brassboard)
- C. End of Flight Test of Brassboard
- D. Start of Development Test and Evaluation
- E. System Demo Flight Tests Begin
- F. System Demo Test and Evaluation Completed
- G. Start of Production
- H. First Test Flight of First Development, Test and Evaluation Aircraft
- I. Development Flight Test Complete (Core)
- J. Interim Operational Capability (Core)
- K. Maritime Radar Flight Test Complete
- L. Standard Configuration Flight Test Complete
- M. Command and Control Improvements Flight Test Complete
- N. Electronic Counter-Countermeasures Flight Test Complete

Date

July 1970
March 1972
August 1972
January 1973
March 1974
December 1974
March 1975
August 1975
January 1977
April 1978
July 1980
October 1981
February 1983
August 1984

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Test and Evaluation Data

1. (U) Development Test and Evaluation

(U) The E-3A Development Test and Evaluation test program was combined with Initial Operational Test and Evaluation test objectives in as realistic an operational environment as possible. The prime development contractor is the Boeing Company. The overall objectives of the test effort were to: (a) validate/verify E-3A performance in accordance with design specifications; (b) determine E-3A performance and capability to fulfill operational requirements, including interservice interoperability demonstrations; and (c) verify Air Force capability to support the E-3A with standard operational maintenance, logistics and training units using prescribed procedures. The first phase of three development test and evaluation phases used a Brassboard engineering model and tested the airworthiness of the rotodome, demonstrated the feasibility of competing overland radar technologies (Hughes and Westinghouse) and demonstrated successful integration of radar targets and computer display equipment. This phase was flown from March through November 1972 and resulted in Westinghouse being selected to continue radar development.

(U) The Systems Integration Demonstration (Phase II) demonstrated successful integration of a single suit of mission avionics which was tested in an electronic countermeasures environment. These tests were flown from March through October 1974 and met or exceeded the performance demonstrated during the Brassboard phase. Test results from the systems integration demonstration phase provided the basis for a production decision.

System Integration Demonstration Development Test and Evaluation Results

Goal Demonstrated

Track Initiation @ 80% of Initial Detection
Track Continuity (Minutes)
Relative Position Accuracy (Nautical Miles)
Maneuver Response
Height Accuracy @ 150 Miles (Feet)
Average Fighter Detection, Nautical Miles

Sea

Farmland

Mountains

Average

Program Element: #27417F(64744F)

DoD Mission Area: Tactical Command and Control, #254

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

(U) Phase III of development test and evaluation was planned to complete air-vehicle, climatic, and mission avionics qualifications and acceptance testing of the core configured E-3A. Three development aircraft and the first production aircraft were flown from August 1975 through January 1977. Test results indicated the E-3A will meet all current mission requirements.

Discrepancies/Deficiencies Found During Development Testing (U)

- (U) Although no deficiencies were uncovered during System Integration Demonstration Testing, Initial Operational Testing revealed 21 improvements which were recommended by the Air Force Test and Evaluation Center and the Tactical Air Command for incorporation into the E-3A. These improvements were evaluated and incorporated as appropriate.
- (U) An aggressive Deficiency Reporting system was established during development, test and evaluation/Initial operational test and evaluation. Of the 653 deficiencies reported, all but three have been studied and corrected as appropriate.

Maintainability and Reliability Testing of the System (U)

- (U) E-3A reliability and maintainability met or exceeded all major design goals and system level specification requirement as measured against engineering standards. The operational reliability and maintainability performance projected for the system is considered satisfactory for a system of this complexity.

2. (U) Operational Test and Evaluation

- (U) The E-3A test program is being conducted as a combined development test and evaluation/initial operational test and evaluation.

Brassboard/Airborne Tracking Phase Initial Operational Test and Evaluation Test Results (U)

- (U) In August 1972, the brassboard E-3A took part in an Air Defense Command operational exercise, Felix Bravo, that included jamming and non-jamming aircraft (simulating an enemy strike force), and an equal number of friendly fighter aircraft. The E-3A radar detected and maintained tracking of all targets and friendly fighter aircraft at maximum range over a variety of terrain conditions. During December 1972, the E-3A participated in a Tactical Air Command operational exercise, Brave Shield III, which involved all the functions of tactical air power, tactical airborne warning and control system concepts, and performance. All test objectives were met. An airborne warning and control system technology demonstration was conducted 10-30 April 1973. The E-3A demonstrated; the ability to track aircraft deep inside political borders where ground North Atlantic Treaty Organization radar systems have no coverages; the ability to detect and track aircraft at low altitude in areas where the North Atlantic Treaty Organization air defense ground environment ground radars were topographically limited; the ability to provide early warning to a HAWK missile site through an experimental

Program Element: #27417F(64744F)

DoD Mission Area: Tactical Command and Control, #254

Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

digital data link; the ability to monitor simulated ground forces in the forward edge of the battle area using identification friend or foe transponders; simultaneous tracking of surface vessels and aircraft; resistance to electronic jamming by tracking numerous targets in close proximity to electromagnetic interference; and interoperability by relaying data for display on ground systems through an experimental digital data communications system.

(U) The E-3A participated in the Amalgam Arrow exercise conducted on 23 May 1973 in the 24th and 25th North American Air Defense Regions. During the exercise, the E-3A operated as an extension of the 25th North American Air Defense Region Control Center via an experimental digital data link.

System Integration Demonstration Initial Operational Test and Evaluation Phase Test Results (U)

(U) Representative tactical scenarios were used to assess the E-3A potential to operate as an extension of the tactical air control system while performing selected functions of a control and reporting center and a control and reporting post. The E-3A effectively performed target detection, tracking, identification, and interception in both a clear and electronic countermeasure environment. E-3A survivability testing, conducted in four phases, was designed to assess E-3A vulnerability to an active fighter threat in a representative tactical environment. Fighter profiles tested (simulating Fishbed, Flogger, and Foxbat Soviet fighters) ranged from single fighter attack to multiple fighters with electronic countermeasures escort (simulated Soviet Brewer E aircraft) attacking the E-3A simultaneously. Various E-3A tactics to avoid detection and interception were assessed. Results show that the E-3A has a high expectancy for survival.

Initial Operational Test and Evaluation Results Following the System Integration Demonstration Phase (U)

The system integration demonstration configured E-3A deployed to Europe during 3-25 April 1975 to demonstrate its capabilities to North Atlantic Treaty Organization defense officials and allied military personnel. Limited initial operational test and evaluation data were collected during the scripted demonstration to further evaluate the operational suitability and effectiveness of the E-3A. From data collected during this deployment, the following observations were made regarding E-3A effectiveness; the E-3A demonstrated a capability to considerably enhance present command and control systems

E-3A maritime surveillance capability radar modification, and the ability to detect and crossstell ground force transponders will add a high degree of flexibility to the effectiveness of the system.

The Air Force Test and Evaluation Center conducted special initial operational test and evaluation tests of the system integration demonstration configured E-3A during 12-19 May 1975 to respond to a House Armed Services Committee request for additional information on the capabilities of the E-3A. Five specific airborne warning and control system areas examined in these tests included; capability against close formation and maneuvering targets; the ability to self-triangulate against concurrently employed ground-based and airborne jammers; capability against self-screening and escort jamming; the ability to resolve target altitude, and track low flying tactical aircraft over varying terrain; the effective-

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tive of the ALT-28 and ALQ-119 jammers against the E-3A. These special tests confirmed the results and conclusions documented in the Air Force Test and Evaluation Center system integration demonstration initial operational test and evaluation report dated November 1974. The E-3A demonstrated its potential operational effectiveness against tactical formations and low altitude and jamming targets.

At the direction of the Office of the Secretary of Defense/Director of Defense Research and Engineering, the Air Force Test and Evaluation Center conducted another special test on 22 May 1975 to obtain data on the capability of the system integration demonstration E-3A to detect, track, and control interceptors while avoiding an aggressor force of radar-equipped interceptors and jammer aircraft in a limited free-play environment. The results showed that the system integration demonstration E-3A, in conjunction with _____ was effective in determining the location of the aggressor raids and engaging them. The results also showed that the

(U) The above tests, along with survivability tests and special electromagnetic compatibility tests, supported authorization to proceed with E-3A production. Details of these tests were reported in the following Air Force Test and Evaluation Center reports: Airborne Warning and Control System Initial Operational Test and Evaluation Final Report, November 1974, Airborne Warning and Control System Free Play Test, June 1975, (S); and Airborne Warning and Control System Special Initial Operational Test and Evaluation, July 1975, (S).

Production Configured E-3A Phase Initial Operational Test and Evaluation Results (U)

The final 16 month phase of Initial Operational Test and Evaluation evaluated the core production-configured E-3A under a variety of operational conditions to assess its operational effectiveness and operational suitability. Two E-3As, test system number 3 and production system number 1, were used during each of the initial operational test and evaluation tests. Test system number 3 contained a full set of production equipment (computers, consoles, radios, etc.) plus the complete suite of special test equipment and instrumentation used for engineering and developing testing. Production number 1 was fully production-configured. The tests during this phase simulated the required operational missions prescribed for the E-3A in the Commander, Tactical Air Command Concept Plan 65 and Commander-in-Chief, North American Air Defense Command/Commander-in-Chief, Air Defense Concept Plan 3111. Scenarios for these tests closely approximated the projected threats in terms of tactics, numbers of aircraft, and electronic countermeasures. Up-to-date intelligence estimates were used to plan/develop realistic hostile force simulations for each scenario. Additional realism was ensured by using a red, white, and blue team concept in staging two-sided battles. Three live tests in the series included Brave Shield XV, a United States Readiness Command joint exercise; a specially designed large-scale tactical operations test; and Vigilant Overview 77-1, a large-scale North America Air Defense exercise. The results of this final phase of initial operational test and evaluation, reported in the Air Force Test and Evaluation Center Phase III

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Initial Operational Test and Evaluation Final Report, September 1977, (S) included assessments of operational effectiveness and operational suitability. Operational Effectiveness. The initial production E-3A can effectively perform the missions prescribed in the Commander, Tactical Air Command, Concept Plan 65 and Commander-in-Chief, North American Air Defense Command/Commander-in-Chief, Air Defense Concept Plan 3111 in a dense electronic countermeasures/threat environment.

It will significantly enhance the capability of the Air Force to conduct and manage tactical and strategic defensive air operations. With the addition of the E-3A, these air operations can be conducted with efficiency and effectiveness that far exceed the capability of current, ground-based and airborne command, control, communications, and surveillance systems. It has a high probability of survival when threatened by hostile fighters. The inherent electronic countermeasures resistivity of its radar enables it to operate effectively in a heavy electronic countermeasures environment.

Operational Suitability. The E-3A is supportable through a mix of organic and interim contractor support. Interim contractor support at organizational, intermediate, and depot level is an important and necessary element in E-3A supportability and will be required until organic Air Force capability is fully established. Interim contractor support is projected to be phased out incrementally as Air Force capability increases. The evaluation of the operational suitability of the E-3A (including interim contractor support) resulted in three logistics elements being rated deficient and needing improvements: (1) maintainability, (2) availability, and (3) support equipment. The major contributors to these deficient ratings were immature reliability, maintainability and supply consumption data, and late radar design stability. These areas caused logistics support decisions to be based on incomplete information. The maintenance plans and concepts are based on the design capability to automatically detect and isolate faults in the mission avionics subsystems. This capability was not sufficiently developed during initial operational test and evaluation to assess its effectiveness as a maintenance tool in three specific areas: (1) surveillance radar, (2) data display and control, and (3) identification. These deficiencies did not prevent achievement of an initial operational capability because interim contractor support made up most of the shortfall. However, continued emphasis should be placed on the correction of deficient supportability areas to achieve a high level of organic support at the earliest possible time.

Core E-3A Follow-on Operational Test and Evaluation (U)

(U) Follow-on operational test and evaluation, initiated in January 1977, was conducted in two phases with operational crews using production aircraft, training equipment, and support equipment. Phase I, Follow-On Test and Evaluation, managed by the Air Force Test and Evaluation Center, was completed in February 1978. This Phase was designed primarily to refine the operational suitability (reliability, maintainability, and logistics supportability) assessment made during initial operational test and evaluation. Because initial operational test and evaluation assessments were constrained by the development, test and evaluation contractor-managed environment, Phase I follow-on test and evaluation provided the first opportunity for a detailed assessment of E-3A suitability under Air Force hands-on maintenance management. The operational effectiveness objectives addressed during Phase I follow-on test and evaluation were those not completed in initial operational test and evaluation, or those where the contractor had made equipment changes

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after initial operational test and evaluation and before production delivery. Tests data were collected on a noninterference basis during the 552 Airborne Warning and Control Wing training for attainment of initial operational capability. No aircraft were dedicated to the test effort. Follow-on test and evaluation flight data were gathered from training missions and during an E-3A deployment to Europe. This deployment, commonly referred to as "EUROTEST 77," provided the first opportunity to assess the logistics supportability of the E-3A in an overseas location. It also provided additional data on the integration of the E-3A into the existing North Atlantic Treaty Organization ground command and control system, and information on the E-3A radar compatibility within the European Central Region electromagnetic environment. The results of this first phase of follow-on test and evaluation were reported in the Air Force Test and Evaluation Center E-3A follow-on test and evaluation Phase I Final Report, July 1978 (S). Test results confirmed that the production E-3A can effectively and efficiently perform its prescribed mission and that the E-3A will greatly enhance the capability of the Air Force to conduct tactical air operations. However, several significant reliability and maintainability problems and deficient logistic support areas were identified for improvement. Phase II Follow-On Test and Evaluation, managed by the Tactical Air Command, was initiated in March 1978 to refine initial operational test and evaluation and Phase I follow-on test and evaluation assessments with emphasis on tactics and procedures. The United States Air Force Tactical Fighter Weapons Center managed the Phase II follow-on test and evaluation for the Tactical Air Command with the test team collocated at the 552d Airborne Warning and Control Wing's main operating base, Tinker Air Force Base, OK. The test team, with representatives from the Tactical Air Command, the North American Air Defense Command and the Air Force Systems Command, conducted the test in conjunction with normal training and maintenance activities of the 552d Airborne Warning and Control Wing. No dedicated resources, beyond the test team, were used for the Phase II evaluation. Major test objectives included; evaluate corrective actions for previously identified deficiencies; refine E-3A tactics and provide information on procedures and doctrine; and verify and refine estimate of the production E-3A operational effectiveness and suitability.

(U) Phase II was completed during May 1980. Test reporting is being accomplished in two parts. Part A of the final report covering the period of March 1978-May 1979 was published in May 1980 while Part B was published in October 1980. A multicommand radar maintenance evaluation lead by the Air Force Test and Evaluation Center was also conducted in parallel with the Phase II to evaluate the E-3A Built-in-Test/Fault-Isolate-Test capability to support daily maintenance activities. This test began in July 1978 and was completed in June 1980. A separate built-in-test/ fault-isolate-test report will be published in November 1980. During Part A, Phase II, the 552d Airborne Warning and Control Wing accumulated over 8,300 flying hours and 1,200 sorties, while participating in 24 major exercises. The test team participated in a cross section of these activities in support of follow-on test and evaluation objectives. Based on data collected thru May 1979, preliminary Phase II findings support the conclusions of initial operational test and evaluation and Phase I follow-on test and evaluation that the production E-3A can effectively perform its prescribed mission. The following results/observations are provided; Tactics and procedures refinement/development: Physical arrangements for the North American Air Defense Command battle staff aboard the core E-3A as previously reported, are insufficient to effectively support E-3A mission crew and command element simultaneously. Additional communications and display consoles are required. Progress has been achieved through interaction between E-3A and functional tactical operations. Baseline procedures were formulated to exploit E-3A look-down capabilities in support of close air support, forward air control

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and rescue missions. E-3A air assault procedures were also developed, providing the commander of airlift forces a real-time presentation of airborne operations.

Tactical control procedures were developed as a result of E-3A interaction with the fighter community in counterair scenarios. This method of control was designed to enhance counterair operations by adjusting E-3A support to the capabilities and requirements of various fighter aircraft. Electronic Counter Countermeasures:

Early Warning and Surveillance: E-3A deep-look and look-down capabilities consistently extended detection and tracking of air targets beyond the coverage of ground based radars. During several exercises, a factor directly related to E-3A orbit locations. Operational Suitability: Operational and hardware reliability were rated satisfactory and reflect a favorable trend. Although significant progress was made, contractor maintenance support is still required. Non-availability of technical orders continues to delay establishment of a full repair capability. Deficiencies in the supply support posture, reported in Phase I, continued to affect the overall availability of mission-capable aircraft. Needed spares are subject to budgetary constraints and production lead times and remain a matter for top-level management. Excessive cannibalization and use of production line loaners will continue to be required for daily operations until inventories reflect true spare requirements.

E-3A Enhancements Initial Operational Test and Evaluation (U)

(U) Background. Decision Coordinating Paper 5, Revision 3, 5 March 1976, approved continued production of the E-3A, and the development of a selected set of system enhancements chosen to provide a fully effective worldwide force. The enhancements were to be developed as separate entities and integrated into the E-3A for testing as the enhancement items became available. In May 1976, the Deputy Secretary of Defense directed the Air Force to plan for an Office of the Secretary of Defense review of the E-3A enhancement program when the respective enhancement development efforts are essentially completed. He further stated that it is contemplated that the Defense Systems Acquisition Review Council would then review development and test status and consider the operational utility of the respective enhancements in light of an updated threat evaluation prior to committing the government to production. The purpose of operational testing of the enhancements is to provide an evaluation of the operational utility of each enhancement for the Defense Systems Acquisition Review Council review. In December 1978, North Atlantic Treaty Organization signed an agreement with the United States Government (as their agent) for the procurement of 18 E-3A aircraft. To support this commitment and the United States standard configured E-3A aircraft, the Air Force received the Office of Secretary of Defense approval for limited production authority for a maritime radar capability and a joint tactical information distribution system capability in E-3 Decision Coordinating Paper Number 5, Revision IV, 6 March 1980.

Past Enhancement Testing. Development test and evaluation/ initial operational test and evaluation of an advanced development joint tactical information distribution system terminal (waveform B) is the only enhancement testing that has been completed. Testing began during May-June 1978 with a preliminary evaluation of the joint tactical information

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962 1655

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distribution system time-division-multiple-access system onboard an E-3A. The purpose of this test was to determine joint tactical information distribution system communications coverage, E-3A system performance in a joint tactical information distribution system environment, and provide an initial estimate of the operational effectiveness/suitability of the time-division-multiple-access communication system planned for the E-3A under the Office of the Secretary of Defense approved enhancement program. This development test and evaluation/initial operational test and evaluation effort provided an opportunity to test the concept of spread spectrum and frequency hopping as a transmission technique in a simulated operational environment. Major emphasis was placed on assessing the electronic counter countermeasures capability of the system. Operational test results demonstrated electronic countermeasures resistivity and operational effectiveness potential of the joint tactical information distribution system terminal. However, until corrected,

Results of this test were reported in the December 1978 Air Force Test and Evaluation Center E-3A Joint Tactical Information Distribution System Terminal Initial Operational Test and Evaluation Report. Planned Enhancement Testing. The United States Standard E-3A (Block 10) configuration is being developed in two steps. Step I, an interim configuration (Block 05), will incorporate enhancements sponsored by the United States Government while Step II will include enhancements sponsored by the North Atlantic Treaty Organization. The United States standard E-3A will be a core E-3A plus maritime surveillance capability, radio teletype writer, a joint tactical information distribution system Hughes improved terminal, upgraded computer program functional group, and modified data analysis processor group. Under the current schedule the United States standard configured E-3A will not be ready for initial operational test and evaluation until September 1981. To the greatest extent possible, development test and evaluation/initial operational test and evaluation of the North Atlantic Treaty Organization E-3A (Block 15) and the United States standard E-3A will be combined. The maritime radar components and software were installed and checked out by the contractor in July 1980. However, the modified data analysis processor group and upgrade computer program functional group through which the maritime surveillance capability must be operated will not be qualified until 1 September 1981. To lower the risk of going into production and to give the Office of the Secretary of Defense some assurance that the maritime radar will meet the operational requirements, a preliminary operation effectiveness assessment of the maritime radar modification was conducted by the Air Force Test and Evaluation Center during 15 July - 30 August 1980. This assessment was limited to determining if the E-3A radar with the maritime modification meets specification requirements and operational performance thresholds. The results indicate that maritime equipped E-3As have the potential to provide a significant capability to conduct or augment combined air/maritime operation.

Results of this test were reported in the October 1980 Air Force Test and Evaluation Center E-3A Maritime Surveillance Capabilities (MSC) Preliminary Operational Effectiveness Assessment Report. The joint tactical information distribution system, Hughes improved terminal will be installed on the E-3A in April 1981 and contractor testing will be completed during September 1981. Although the joint tactical information distribution system, Hughes improved terminal will not be installed on the E-3A in 1980, a version of this terminal will be included in the joint tactical information distribution system adaptable surface interface terminal recently tested by the Air Force Test and Evaluation Center. A preliminary joint tactical information distribution system, Hughes improved terminal hardware assessment has been made.

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(U) The Block 20/25 configuration will be a retrofit program of the Block 01 (core) and Block 10 configured E-3As. Block 20 will consist of Block 01 plus the joint tactical information distribution system, computer modification, telewriter, five ultra high frequency radios, three situation display consoles, and a command console enhancement. Block 25 will consist of Block 10 plus five ultra high frequency radios, three situation display consoles and a command console enhancement. Testing of these enhancements is expected to begin in 1983. Retrofit is expected in 1984. The Block 30/35 configuration will be a retrofit of selected electronic counter countermeasure's improvements into the Block 20/25 aircraft. Testing of these improvements is tentatively planned to begin in 1986.

3. (U) Operational and Technical Characteristics

(U) Comparison System Integration Demonstration (Test System 1)/Production

(U) GENERAL

	<u>TEST SYSTEM #1</u>	<u>E-3A/CORE-1</u>
Crew Size	11	17
Production or Production Prototype Systems		
Radar	NO	YES
Navigation	YES	YES
Data Processor	YES	YES
Display	YES	YES
Identification Friend or Foe	YES	YES
On-Board Test Maintenance and Monitor	YES	YES
Communications	PARTIAL	YES

(U) HARDWARE

Consoles

Auxiliary Display Unit	4	9
Ultra High Frequency Radios	1	2
High Frequency Radios	4	14
Very High Frequency Amplitude Modulation Radios	1	2
Very High Frequency Frequency Modulation Radios	2	3
	0	1

1055
1055

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Title: Tactical Airborne Command and Control System
Budget Activity: Tactical Programs, #4

CAPABILITY

Radar Targets/Scan
Identification Friend or Foe Targets/Scan
Data Processing Track Capacity
Data Processing Simultaneous Intercept

TEST SYSTEM #1

E-3A/CORE1/

1/ Test Systems #3 and #4 are identical to Core Production aircraft in terms of the listed parameters. Test Systems #1 and #2 have been retrofitted to production configuration. Test system #3 will be delivered to the operational force after completion of enhancement testing.

Comparison E-3A Requirements to Current Estimates (U)

TECHNICAL CHARACTERISTICS

Detection Range (0.9 Probability in 1 Minute)

Bomber (Nautical Miles)

Fighter (Nautical Miles)

Crew Size

System Track Capacity

Simultaneous Intercepts

Targets Position Accuracy (Nautical Miles)

Time on Station, Orbit 1000 Nautical Miles from Base (hours)

E-3A CORE
REQUIREMENTS

17

DEMONSTRATED
PERFORMANCE

17

(U) RELIABILITY AND MAINTAINABILITY CHARACTERISTICS

Probability of Completing 9 hour Mission

Maintenance Manhour/Flight Hour

In Commission Rate

Probability of Fault Detection

Probability of Fault Isolation (To 3 Primary Units)

Turn Around Time

False Alarm (Probability of not Detecting Failure)

DESIGN
REQUIREMENTS

0.88

28.0

80%

95%

90%

90% in 5.5 hours

0.8%

DEMONSTRATED
PERFORMANCE

.88

37.8*

95.7%

97%

95%

90% in 4.8 hours

.03

*Actual data experienced during FY 1980 for aircraft delivered to TAC.

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Budget Activity: Tactical Programs, #4

Design Requirements for E-3A Improvements (U)

TECHNICAL CHARACTERISTICS

Maritime Radar

Maximum Detection at 250 Nautical Miles or Line-of-Sight

Patrol Boat (Foot Waves)

Destroyer (Foot Waves)

Maritime Targets Position Accuracy (Nautical Miles/Degree)

Maritime Targets Position Accuracy with Electronic

Countermeasures (Nautical Miles)

Maritime Targets Detection Range with Electronic

Countermeasures (Nautical Miles)

Maritime Target/Land Resolution (Nautical Miles)

Joint Tactical Information Distribution System

Message Transfer Ratio (Percent)

E-3A Data Base Transfer (Minutes)

Electronic Counter Countermeasure Margin (Decibels)

Net Initialization Time (Minutes)

Net Entry Time (Minutes)

Terminal Initialization Time (Minutes)

THRESHOLD

GOAL

1057
1058B
1057
1058B
966

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27423F

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

DoD Mission Area: Tactical Command and Control, #254

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total	
							Estimated Cost	Not Applicable
TOTAL FOR PROGRAM ELEMENT								
2277	SEEK TALK	11,890	43,100	49,900	2,000	0	115,800	
2482	HAVE QUICK	1,900	0	0	0	0	8,800	
2614	SINGGARS-V Integration	200	1,500	1,500	1,000	Continuing	Not Applicable	
2766	Adaptive High Frequency Communication			400	200	Continuing	Not Applicable	

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED:

The Air Force relies solely on UHF for its primary tactical command and control. Disruption of these communications could degrade the effectiveness of tactical forces by SEEK TALK is an advanced technology program intended for all UHF voice communications and will provide jam resistance independent of the long term threat. HAVE QUICK is an interim program to apply demonstrated technology and provide an urgently needed resistance to jammers. The Air Force will participate with the Army to plan for the integration of the Single Channel Ground and Airborne Radio System (SINGGARS) VHF jam resistant capability in those weapon systems requiring direct communications with Army forces. The Adaptive HF program will evaluate currently available technology to provide an alternative to satellite communications and provide worldwide connectivity. This is part of an overall program directed and coordinated by the Joint Chiefs of Staff.

(U) BASIS FOR FY82 RDT&E REQUEST: United States tactical forces are required to conduct tactical operations in a complex communications environment which is increasingly subject to electronic countermeasures. SEEK TALK will complete Full Scale Engineering Development and begin development and operational testing. Development and operational testing will emphasize SEEK TALK as a system integrated into the Tactical Air Command and Control System and use the most advanced countermeasures technology available to the United States. The Air Force will continue to participate in the Army's SINGGARS development and operational testing programs. A modification to Air Force VHF radios and aircraft antennas will be developed to insure interoperability with the Army. Adaptive HF add-on modules to existing Air Force radios will be tested to assess the utility of off-the-shelf capability.

967 1059 (1059)

Program Element: #27423F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated Cost
RD&E	12,000	44,600	25,800		Continuing	Not Applicable
PROCUREMENT						
2482 - HAVE QUICK						
(Aircraft)	16,100	14,300			30,400	
(Other)	2,000				2,000	

(U) OTHER APPROPRIATION FUNDS:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated Cost
2277, SEEK TALK						
PROCUREMENT						
(Aircraft)						
(F-16)				9,100	Not Applicable	Not Applicable
(A-10)				12,400	Not Applicable	Not Applicable
(OV-10)				3,500	Not Applicable	Not Applicable
(Other)				16,019*	Not Applicable	Not Applicable

*Includes initial spares

(U) Initiates procurement and nonrecurring of 67 initial SEEK TALK fighter and ground units; and support equipment.

1060
1060

Program Element: #27423P

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: Soviet doctrine for Radio Electronic Combat (REC) states that

the Air Force is facing an effective and rapidly increasing electronic countermeasures (ECM) threat. Soviet jamming equipment is currently deployed in Europe and North Korea. This threat could be in support of NATO, South Korea or friendly nations elsewhere in the world. This program is an initiative to provide jam resistant Ultra High Frequency (UHF), Very High Frequency (VHF) and High Frequency (HF) communications.

(U) CURRENT PROJECTS IN THIS PROGRAM:

Project Number:

2482

HAVE QUICK: This project is applying current technology to modify a limited number of Air Force UHF voice radios. This modification will protect these communications from the

HAVE QUICK started production in FY 1980 and will protect the most critical aircraft communications during the time required to develop a more advanced technology (SEEK TALK) which will be less sensitive to rapidly evolving jamming technology. HAVE QUICK has been directed by the Joint Chiefs of Staff as the US standard for interoperability.

2277

(U) SEEK TALK: This project will develop, produce and implement an advanced technology jam-resistant UHF voice communication system less sensitive to the evolution of jamming technology. SEEK TALK will combine pseudo-random noise modulation and adaptive antenna techniques to provide a jam-resistant capability satisfying the urgent operational requirement. SEEK TALK will start Full Scale Engineering Development in FY 1981 and will accomplish the preliminary modification engineering efforts necessary to deploy SEEK TALK in aircraft and ground command and control systems.

2614

(U) SINGGARS-V Integration: The Army Single Channel Ground and Airborne Radio (SINGGARS) program will modernize all the tactical single channel voice VHF radios used by the Army. The Army is providing a module to these radios which will provide a secure jam resistant capability. The Air Force is participating with the Army to modify airborne radios and provide a compatible jam resistant capability for its VHF radios. The integration of this capability into Air Force aircraft will insure interoperability with Army ground forces in a jamming environment. The SINGGARS Integration project provides for Air Force planning for SINGGARS integration and development of Air Force unique equipment.

Program Element: #27423F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

2766

Adaptive High Frequency (HF) Communication: This project will develop specifications and demonstrate adaptive HF add-on modules to existing SCOPE SIGNAL, PACER COMET and ARC-190 radios. These modules will provide automatic frequency selection, adaptive connectivity and will ensure compatibility with existing HF terminals. Versions of these modules have been tested in operational Military Airlift Command aircraft. Adaptive HF activities are coordinated through PE 33131F, Minimum Essential Emergency program which manages overall Air Force efforts in this area. This effort is part of a Joint Service coordinated program.

(U) RELATED ACTIVITIES: The Air Force is participating in the Army Single Channel Ground and Airborne Radio System (SINGGARS) program PE 63746A as part of the Joint Chiefs of Staff validated Joint Operational Requirement. Requirements and technical approach are presently being explored with the Navy and Army for the purpose of insuring interoperability. Formal interoperability tasks are part of this program and techniques which are developed by the Air Force, as the Joint Chiefs of Staff lead Service for the development of technical specifications will be coordinated with similar techniques being developed by the other Services. Adaptive HF activities are coordinated through PE 33131F, Minimum Essential Emergency Communication Network (MEECN) which provides overall Air Force focal point for coordination.

(U) WORK PERFORMED BY: The HAVE QUICK and SEEK TALK programs are managed by the Air Force Systems Command (AFSC), Electronic Systems Division Hanscom AFB, MA. The advanced development phase of SEEK TALK has been contracted for and tested by the Rome Air Development Center, Griffiss AFB, NY. The MITRE Corporation, Bedford, MA, supports the Air Force as general systems engineer. Contractors include: Hazeltine Corporation, Greenlawn, NY; General Electric Company, Utica, NY; Sanders Associates Inc, Nashua, NH; TRACOR, Los Angeles, CA; Magnovox, Fort Wayne, IN, and Collins Radio, Cedar Rapids, IA.

(U) Program Accomplishments & Future Programs:

- (U) FY 1980 and Prior Accomplishments: The HAVE QUICK program has completed Full Scale Development; Development Test and Evaluation; and Initial Operational Test and Evaluation. The HAVE QUICK production contract was awarded to Magnavox and an initial 760 units were procured. A consolidated study of Air Force integration alternatives to achieve interoperability with the Army Single Channel Ground and Airborne Radio System SINGGARS was completed. SEEK TALK complete development and fabrication of Advanced Development equipment and has completed contractor testing by General Electric and Hazeltine Corporations.
- (U) FY 1981 Program: HAVE QUICK production will continue with 1565 units to be procured in FY 1981. Initial field installations of HAVE QUICK equipment will begin in February 1981. HAVE QUICK development, integration and qualification for the ground tactical command and control environment will continue. Electromagnetic compatibility analysis of SINGGARS

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Program Element: #27423F

DoD Mission Area: Tactical Command and Control, #254

Title: Advanced Communication Systems
Budget Activity: Tactical Programs, #4

aircraft integration will continue. Alternatives for modifying existing Air Force radios for SINGCARS will be evaluated in detail with specific designs being developed after the Army design approach is chosen. Electronic counter-countermeasures antenna design or modification for fighter aircraft to allow Single Channel Ground and Airborne Radio System (SINGCARS) installation will be started. Related support and intelligence efforts will continue and be paced by the Army's schedule. SEEK TALK will begin detailed government development and operational test and evaluation of Advanced Development equipment. This test program will provide detailed technical analyses and a detailed operational assessment. SEEK TALK will begin Full Scale Engineering Development with initial design activities being completed during this year. Additional efforts to minimize aircraft integration cost, develop special test equipment and other support efforts will continue.

3. (U) FY 1982 Planned Program: The production and deployment of HAVE QUICK equipment will be completed and made fully operational. Air Force participation in the Army SINGCARS program will continue. Design efforts for modification of Air Force radios will be completed. Antenna design for the integration of SINGCARS into airborne applications will continue. SEEK TALK will complete Full Scale Engineering Development of the overall system design; fighter terminals; ground command and control units; and support equipment. A detailed design and operational test and evaluation program will begin. This test program will insure thorough evaluation of system performance against high technology threats. Evaluation of industrially developed Adaptive HF add-on modules for existing radios will begin. It is expected that this evaluation will lead to a minimum cost means of improving HF communication. Program costing is based on Air Force estimates and contractor proposals. Production estimates are based on Budgetary Cost Estimates for weapon system modifications.

4. (U) FY 1983 Planned Program: Design of SINGCARS modifications will be completed. Test and Evaluation of these radio and antenna modifications will begin. SEEK TALK will complete development and operational testing with the production decision scheduled for the second quarter of FY 1983. Low Rate Initial Production will begin. Evaluation of Adaptive High Frequency add-on modules will be completed with a recommendation for future procurement of continued development. Program costs are based on price models and Budgetary Cost Estimates for equipment production.

5. (U) Program to Completion: With the successful completion of the Army SINGCARS program, Air Force production of a SINGCARS modification is expected in FY 1984. SEEK TALK will complete Low Rate Initial Production in FY 1984 leading to initial equipment installation in FY 1985 and an operational capability by late FY 1985.

6. (U) Milestones: Not Applicable

Project: #2277

Program Element: #27423P

DoD Mission Area: Tactical Command and Control, #254

Title: SEEK TALK

Title: Advanced Communication Systems

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: As a result of United States (US) experience in Southeast Asia and it is apparent that the Air Force is facing a rapidly increasing electronic countermeasures (ECM) threat. This threat

The Air Force SEEK TALK program will develop and implement an air-air and air-ground-air ultra high frequency (UHF) voice communications capability that will permit the Tactical Air Forces (TAF) to fulfill their mission despite hostile enemy communications jamming. SEEK TALK is being developed in response to TAF Required Operational Capability (ROC) 321-75 and the CORONET CLEAR study. SEEK TALK will use pseudo-random noise conferencing modulation and adaptive antenna nulling to provide resistance to hostile jamming.

(U) The pseudo-random noise conferencing modulation will be provided by the development of a spread spectrum modem that retains the desirable features of the present amplitude modulated (AM) radio. The specific features desired include: voice input and output, reasonable intelligibility, a minimum of knobs and switches, unlimited simultaneous transmissions, conferencing capability and simultaneous reception of multiple signals. Several of these requirements are unique to the TAF voice air-ground-air communications systems and have not been addressed in previous jam resistant communications research and development programs. The modem will be capable of providing these requirements in an ECM environment.

(U) The adaptive antenna array task will be pursued concurrent with the spread spectrum modem development. The adaptive null steering antenna processor development will exploit technology which uses the adaptive loops to either equalize the power of all jamming and communication signals received (power equalization) or improve the antenna pattern in the direction of desired signals and places nulls in the direction of interfering signals. The adaptive antenna processor will be designed to operate in a power equalization mode with the conventional AM radio signal (providing interoperability with conventional UHF communications) and with the spread spectrum modem to place a null in the direction of the interfering signals.

(U) The SEEK TALK program structure contains four phases, emphasizing competition. These phases (Concept Design, Concept Validation, Full Scale Engineering Development, and Production) will emphasize system life cycle cost and maintain competition by systematically reducing the number of contractors at the end of each phase. The Air Force is continuing to address joint service and NATO interoperability as high priority issue through the Joint Chiefs of Staff.

Project: #2277

Program Element: #27423F

DoD Mission Area: Tactical Command and Control, #254

Title: SEEK TALK

Title: Advanced Communication Systems

Budget Activity: Tactical Programs, #4

(U) RELATED ACTIVITIES: Requirements and technical approach are presently being explored with the Navy and Army for the purpose of insuring interoperability. Formal interoperability tasks are part of this program and techniques which are developed by the Air Force, as the Joint Chiefs of Staff lead Service for the development of technical specifications will be coordinated with similar techniques being developed by the other Services. Prior to FY 1980, this project was funded under PE 63727F, Advanced Communication Technology. SEEK TALK special test activities are managed by the Naval Research Laboratories, Bolling AFB, Washington DC.

(U) WORK PERFORMED BY: The SEEK TALK program is managed by the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA, with technical phases of the programs being contracted and tested by the Rome Air Development Center, Griffis AFB, NY. The MITRE Corporation, Bedford, MA supports the Air Force as systems engineer. Contractors include: Hazeltine Corporation, Greenlawn, NY; General Electric Company, Utica, NY; Sanders Associates Inc., Nashua, NH; ARINC Research Inc., Annapolis, MD; Calspan Inc., Buffalo, NY; Motorola Inc., Scottsdale, AZ; and TRACOR, Los Angeles, CA.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1980 and Prior Accomplishments: SEEK TALK system requirements and threat studies have been completed. Four competing system Concept Design studies were completed including interface designs for other Service equipment. The Concept Validation phase began in March 1979 with contractual awards for the fabrication of three competing Advanced Development designs. Fabrication of Advanced Development equipment and contractor flight testing has been completed. Electromagnetic system design vulnerability analysis, compatibilities analysis and aircraft integration studies were started and will continue through production decision.
2. (U) FY 1980 Program: Government laboratory, static and flight testing of Advanced Development equipment began in December 1980. This test program will include detailed development, design vulnerability and operational testing. System design vulnerability analysis, electromagnetic compatibility analysis and aircraft integration studies will continue. Revised threat assessments and other supporting efforts will be started. Full Scale Engineering Development will begin with production design studies due to be completed in early FY 1982.
3. (U) FY 1981 Planned Program: SEEK TALK Full Scale Engineering Development production design and integration efforts will be completed. Engineering prototype equipment will be fabricated, and preparation of Low Rate Initial Production of this equipment will be started. Detailed, in-depth development and vulnerability testing will be accomplished with the most advanced jamming technology available. Initial Operational Test and Evaluation will begin. System vulnerability electromagnetic compatibility, threat and integration studies will be completed. Preparation for a production decision will begin.

Project: #2277

Program Element: #27423P

DoD Mission Area: Tactical Command and Control, #254

Title: SEEK TALK

Title: Advanced Communication Systems

Budget Activity: Tactical Programs, #4

4. (U) FY 1982 Planned Program: Initial Operational Test and Evaluation will be completed. Following the production decision in the second quarter of FY 1983 Low Rate Initial Production will begin and provide an Initial Capability during FY 1985.

5. (U) Program to Completion: Production, installation and deployment of equipment beyond the Low Rate Initial Production will continue with emphasis on contracting techniques to minimize life-cycle costs.

6. (U) Milestones:

Event	Date
Concept Phase	Feb 1978-Sep 78
Validation Phase	
Design and Fabrication	Mar 1979-Dec 1980
Development Testing	Dec 1980-Jun 1981
Operational Testing	Mar 1980-Jun 1981
Full Scale Engineering Development	
Design and Fabrication	Jan 1981-Jul 1982
Development Testing	Jul 1982-Dec 1982
Initial Operational Testing	Jul 1982-Dec 1982
Production Decision	Jan 1983
Production	
Low Rate Initial Production	Jan 1983-2Q 1985
Full Production	2Q 1985-2Q 1990
Initial Capability	4Q 1985

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Complete	Total Estimated Costs
RDTS&E	11,890	43,100	49,900	2,000	0	115,800
Procurement						
(Aircraft)						
(F-16)				9,100	Not Applicable	Not Applicable
(A-10)				12,400	Not Applicable	Not Applicable
(OV-10)				3,500	Not Applicable	Not Applicable
(Other)				16,100*	Not Applicable	Not Applicable

* Includes procurement spares

(U) Initiates procurement and non-recurring for 67 initial SEEK TALK Low Rate Initial Production fighters and ground units; and support equipment.

Project: #2277

Program Element: #27423F

DoD Mission Area: Tactical Command and Control, #254

Title: SEEK TALK

Title: Advanced Communication Systems

Budget Activity: Tactical Programs, #4

4. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Estimated</u>
	<u>Actual</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Complete</u>	<u>Costs</u>
RDT&E	9,900	41,000	24,000		2,000	88,900

(U) During FY 1979 the SEEK TALK program was restructured to reflect actual expected Full Scale Engineering Development cost, accelerate the production decision to FY 1983, and prepare for expedited production and installation of SEEK TALK equipment. Refinement of Full Scale Engineering Development cost estimates and inclusion of development funding leading into the Low Rate Initial Production program has increased the FY 1982 estimate by \$24,100 thousand from the FY 1981 President's Budget. Production funding of \$40,800 thousand has been included in FY 1983 for the Low Rate Initial Production program.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27431F (64701F) (27415F)
 DOD Mission Area: Tactical Surveillance, Recon-
naissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
 Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2390	WS-430B Enhancement	352					3,100
2394	Operational Application of Special Intelligence Systems (OASIS)*			9,139	6,797		39,100
2514	Imagery Interpretation (II)	750	500				10,400
2516	Display Control/Storage and Retrieval (DC/SR)			161	403		43,200
2517	Battlefield Exploitation and Target Acquisition (BETA)**	4,788					
2539	System Integration and Program Support	1,100	900				20,100
2576	Tactical Fusion Division**						
2596	Compass Quasar	2,000					2,000
2604	United States Air Forces in Europe Tactical Air Intelligence System (UTAIS) Architecture	700	1,600			7,700	10,000
				9,300	7,200	Continuing	Not Applicable

* \$5.0M in FY 80 and \$6.3M in FY 81 was funded in PE 27415F; OASIS transferred to PE 27431F beginning in FY 82.
 ** Per Congressional re-direction of these projects, all funding will be used for the development of the Joint Tactical Fusion Program under PE 64321F.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The tactical forces are faced with a critical deficiency in their capability to rapidly and accurately process, interpret, and disseminate information from various intelligence collection systems. The purpose of this program is to develop and acquire mobile, land based processing, interpretation and exploitation systems for use by tactically deployed general purpose forces. TAIS Activities is an intelligence system program element that includes five functional development projects: Imagery Interpretation, Display and Control/Storage and Retrieval, System Integration and Program Support, and United States Air Forces in Europe Tactical Air Intelligence System Architecture (Compass Quasar was transferred in Fiscal Year 1981 to Program Element 28019, Tactical Cryptologic Program; Battlefield Exploitation and Target Acquisition and Tactical Fusion Division projects were combined and transferred in Fiscal Year 1981 to new PE 64321F, Joint Tactical Fusion Program; Operational Application of Special Intelligence Systems will be transferred to this Program Element in Fiscal Year 1982 from Program Element 27415).

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #27431F (64701F) (27415F) Title: Tactical Air Intelligence System (TAIS) Activities
DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #255 Budget Activity: Tactical Programs, #4

(U) The Operational Application of Special Intelligence Systems (OASIS) program will develop software and procure the hardware to enhance the source-limited and primarily manual capabilities of United States Air Forces in Europe's Tactical Fusion Center. The improvements are of paramount importance in assuring the effective crisis/warime employment and security of United States Air Force units in Europe.

(U) BASIS FOR FISCAL YEAR 1982 RDT&E REQUEST: This request includes funds for the Tactical Information Processing and Interpretation program to correct deficiencies for the Display and Control/Storage and Retrieval Segment. The funds requested would also provide for continued OASIS software development to receive, integrate, distribute and display intelligence and operational data in a useable format. Also, an upgrade of the existing information processing systems hardware will continue. These estimates are developed by the Air Force Systems Command Program Offices with assistance of MITRE and the contractors.

(U) COMPARISON WITH FISCAL YEAR 1981 DESCRIPTIVE SUMMARY:

Project Number RDT&E	Title	TOTAL FOR PROGRAM ELEMENT	FY 1980		FY 1981		FY 1982		FY 1983		Additional To Completion Continuing	Total Estimated Costs	
			Actual	15,590	Estimate	14,600	Estimate	18,000	Estimate	13,500		Not Applicable	Not Applicable
2390	WS-430B Enhancement		352									3,000	
2394	Operational Application of Special Intelligence Systems (OASIS)		5,900		6,200		8,800		6,500			38,800	
2514	Imagery Interpretation (II)		750		200							9,757	
2516	Display and Control/Storage and Retrieval (DC/SR)				100							43,043	
2517	Battlefield Exploitation and Target Acquisition (BETA)		4,788		1,900							17,340	
2539	System Integration and Program Support		1,100		200		300		5,900		11,300	19,050	
2576	Automated Tactical Fusion Division		2,000		3,600		7,500					28,500	
2596	Compass Quasar											2,000	
2604	USAFE Tactical Air Intelligence System (UTAIS) Architecture		700		2,400		1,400		1,100		8,400	14,200	
	Procurement (Other)		998		076		4,400		2,700		Continuing	Not Applicable	

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Program Element: 27431P

DOD Mission Area: Tactical Surveillance, Recon-
naissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: Tactical Programs, #4

(U) OTHER APPROPRIATION FUNDS:

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	Procurement (Other) (3080) (Quantity)						
2394	Operational Application of Special Intelligence Systems (OASIS)						4,990
2516	Display and Control/Storage and Retrieval (DC/SR)				2,934		8,434
	Operation and Maintenance (3400)						
2394	Operational Application of Special Intelligence Systems (OASIS)			3,931	4,197	618	25,800
2514	Imagery Interpretation (II)	760	3,600	1,700	3,400	6,151	
2516	Display and Control/Storage and Retrieval (DC/SR)	475		1,300			1,300

Program Element: #27431F

DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The tactical forces in the field have continually been faced with a critical deficiency in their capability to rapidly and accurately interpret information collected by reconnaissance aircraft and their timely handling and distribution of all intelligence products. Methods of collection have kept pace with technological advances, but the capability to rapidly exploit the information remains constrained by slow, inaccurate manual methods. To overcome these deficiencies, Program Element (PE) 64701F, Tactical Information Processing and Interpretation (TIPI) System development, was initiated as a joint Air Force, Army, Marine Corps program with the Air Force as Executive Agent. TIPI Research Development Test and Evaluation funds were transferred to PE 27431F as of 1 October 1978. The TIPI system will apply automatic data processing techniques to enhance exploitation and collation. This automation will assist in providing finished intelligence to a deployed commander in a useable time frame. The TIPI program objective is to develop air transportable facilities that provide for processing, reproducing and interpreting aerial reconnaissance and surveillance products; collating with intelligence from all other sources; reporting on enemy force activities; preparing and distributing target materials; and supporting mission planning. The equipment will be shelterized and will be modularized so that appropriate numbers and types can be used at any location depending upon the size and nature of the job. The system will be composed of functionally independent segments that will be interpretable and capable of interfacing with other systems. In recognition of the requirement for a multi-source correlation facility, the Joint Battlefield Exploitation and Target Acquisition (BETA) demonstration was initiated. BETA is a test bed to provide near-real time targeting data and battlefield status information to tactical field commanders. The Tactical Fusion Division project is the Air Force follow-on project for BETA to develop, produce, and field multi-source correlation facilities based upon BETA technologies. The Compass Quasar project is to develop and field equipment interfacing with the Tactical Air Control System and a classified source. Additional details on Compass Quasar are available to properly cleared personnel. United States Air Forces in Europe Tactical Air Intelligence System (UTAIS) Architecture will start a systematic improvement of the United States Air Forces in Europe Tactical Air Intelligence System.

The Operational Application of Special Intelligence Systems project provides evolutionary improvements to United States Air Forces in Europe's Tactical Fusion Center, the command and control center for the Allied Air Forces Central Europe.

(U) RELATED ACTIVITIES: The TIPI program will provide mobile land based facilities only and is complementary to Navy programs which provide similar capabilities aboard ships. The program is managed by a jointly manned Program Office (PO). Certain related but peculiar Marine Corps and Army requirements are funded and managed by the Marine Corps and Army. Each Service will budget separately for production, but the procurements will be jointly managed by the PO. The Photo Interpreter Report and Edit Station, to be used in Air National Guard Enhanced WS-430B, was developed in PE 64750F, Intelligence Equipment, Project 2716.

(U) WORK PERFORMED BY: Air Force management is provided by Electronic Systems Division, Hanscom AFB, MA, supported by Rome Air Development Center, Griffiss AFB, NY, and Aeronautical Systems Division, Wright-Patterson AFB, OH. Contractors are: Texas Instruments Incorporated, Dallas, TX - Imagery Interpretation (II); Fairchild-Hiller Corporation, Germantown, MD - II subassemblies; Raytheon Corporation, Alexandria VA - II subassemblies; General Electric Corporation, Daytona Beach, FL - system integration service; Radio Corporation of America, Burlington, MA - Display and Control/Storage and Retrieval, Mead Laboratories, Dayton, OH - Enhanced WS-430B; E Systems, Melpar Div, Falls Church, VA - Compass Quasar; and TRW, Redondo Beach, CA - Battlefield Exploitation and Target Acquisition.

Program Element: #27431F

DOD Mission Area: Tactical Surveillance, Recon-
naissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

Project 2390 - WS-430B Enhancement. The Imagery Processing (Enhanced WS-430B) segment contains the equipment to develop and reproduce reconnaissance film. This segment will not be a new development, but will be a modified and updated version of the existing WS-430B Photo Processing and Interpretation Facility. Engineering development of WS-430B shelters selected for prototyping was initiated in FY 1977. Tests were initiated on an automatic photographic chemical mix module and a packaged waste water treatment system. This type of commercial equipment is planned for use in the Enhanced WS-430B. Shelterization of one Advanced Tactical Processor to provide a large roll film processing capability for Pacific Air Forces (PACAF) was completed in FY 1977 and delivered to PACAF in January 1978. In August 1978, the WS-430B Enhancement contract for prototype development was awarded to Mead Laboratories of Dayton, OH. Development of the Enhanced WS-430B continued throughout the year.

Project 2514 - Imagery Interpretation (II). The II segment is comprised of three shelters containing automated equipment and communications to enable the photo interpreter to rapidly and accurately extract and disseminate information from tactical reconnaissance imagery. The segment completed development and testing in December 1974. The production decision was made in January 1975. On 28 February 1975, an II prototype was deployed to Zweibrucken Air Base, Federal Republic of Germany, for formal demonstrations and training. In May 1977, the production contract was awarded to Texas Instruments. The follow-on contract to complete production of the II segments was awarded to Texas Instruments in September 1978 to complete Air Force requirements and satisfy initial Army requirements. In December 1978, a decision was made that the II also provide Tactical Electronic Reconnaissance processing and data link capability. Three Air Force and two Marine Corps segments were delivered in FY 1980. The production efforts continued.

Project 2516 - Display and Control/Storage and Retrieval (DC/SR). The DC/SR is a six shelter segment containing the automated equipment and analysts' consoles necessary to enable intelligence personnel in a Tactical Air Control Center to correlate intelligence data from all sources and to perform intelligence analysis, threat assessment, collection management and target planning in a timely manner. Development and testing was completed in October 1975. During the testing, the computer response time was too slow to satisfy the Tactical Air Command requirement and a complete software and hardware analysis was performed. The software was simplified and hardware improvements were initiated to decrease the response time. The DC/SR was deployed to the Brave Shield XV Exercise in October 1976 and software/hardware improvements accomplished in FY 1976 were satisfactorily demonstrated. During October 1977, the DC/SR participated in the Bold Eagle Exercise at Hurlburt Field, FL. Eight DC/SR displays were successfully integrated into the Tactical Air Control Center during the exercise. During FY 1978, the second DC/SR procurement package was released to RCA of Burlington, MA. The second DC/SR was delivered in January, 1980.

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Program Element: #27431F

DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: Tactical Programs, #4

- Project 2539 - System Integration & Program Support. For the Tactical Information Processing and Interpretation (TIPI) system to operate as an efficient integrated intelligence processing system, management attention was directed to inter-system interoperability; commonality of support equipment, data bases, development/production requirements; and interoperability with other tactical and strategic systems required by the using command and higher headquarters direction. To aid the TIPI Program Office in these efforts, the services of an industrial system integration and checkout contractor were obtained. For the past ten years, system integration and checkout tasks have been performed by General Electric Corporation, Daytona Beach, FL, to ensure an integrated approach to conduct appropriate technical analysis, to support program reviews, and to provide test support.
- Project 2596 - Compass Quasar. System development was conducted in Program Element 31011G(F), Consolidated Cryptologic Program, Project 1001.
- Project 2604 - United States Air Forces in Europe Tactical Air Intelligence System (UT AIS) Architecture. The project will start a systematic layout of the UT AIS to determine the proper architecture and overall improvements necessary to the major segments and driving function in the European command and control environment. This effort will concentrate on the Combat Operations Intelligence Center as the central segment and will prepare a Request for Proposal to start improvement on the other segments in the architecture.
2. (U) FY 1981 Program:
- Project 2390 - WS-430B Enhancement. The prototype contract will be completed; Development Test and Evaluation/Initial Operational Test and Evaluation will begin in first quarter, FY 1981.
- Project 2514 - Imagery Interpretation (II). Software and communications updates will continue. These updates to the computer memory circuits, common chassis design, power supply, and input-output devices will provide state-of-the-art computer circuits and maintenance functions for faster and easier fault identification. Tactical Electronic Reconnaissance processing will be incorporated into production IIs. Production will continue.
- Project 2516 - Display and Control/Storage and Retrieval. Management responsibility for the system will transfer from Air Force Systems Command to Air Force Logistics Command in March, 1981.
- Project 2539 - System Integration and Program Support. The contractor will continue the Tactical Information Processing and Interpretation system development and production integration tasks through FY 1981. Project completed at end of fiscal year.
- Project 2604 - Contract award to BETAC Corporation on 22 Oct 80. Architectural analysis will continue.

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Program Element: #27431F

DOD Mission Area: Tactical Surveillance, Reconnaissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program:

Project 2514 - Imagery Interpretation (II). Delivery of production II segments will be complete.

Project 2516 - Display and Control/Storage and Retrieval (DC/SR). Program Management Responsibility Transfer discrepancies will be corrected.

Project 2604 - United States Air Forces in Europe Tactical Air Intelligence System (UTAIS) Architecture. Project deferred.

The difference in total program cost is the transfer of projects 2517 and 2576 to PE 64321F, Joint Tactical Fusion Program, and the transfer of project 2394 from PE 27415F, USAFE C, to this program element.

4. (U) FY 1983 Planned Program:

Project 2604 - UTAIS Architecture. Project deferred.

Other Procurement - Display and Control/Storage and Retrieval. Program Management Responsibility Transfer discrepancies will be corrected.

The difference in total program cost is the transfer of projects 2517 and 2576 to PE 64321F, Joint Tactical Fusion Program, and the transfer of project 2394 from PE 27415F, USAFE C, to this program element.

5. (U) Program to Completion:

Project 2604 - United States Air Forces in Europe Tactical Air Intelligence System (UTAIS) Architecture. Combat Operations Intelligence Center (COIC) enhancement and improvements to UTAIS architecture will continue to keep pace with the evolving control and threat environment.

The difference in total program cost is the transfer of projects 2517 and 2576 to PE 64321F, Joint Tactical Fusion Program, and the transfer of project 2394 from PE 27415F, USAFE C, to this program element.

6. (U) Milestones:

Date

- A. Display and Control/Storage and Retrieval Initial Operational Test and Evaluation
- B. Imagery Interpretation Production Contract Award

31 Oct 75
29 May 77

Program Element: #27431F

DOD Mission Area: Tactical Surveillance, Recon-
naissance and Target Acquisition, #255

Title: Tactical Air Intelligence System (TAIS) Activities
Budget Activity: Tactical Programs, #4

C. Enhanced WS-430B Prototyping Complete	* (Sep 80)	Dec 80
D. Delivery of Second DC/SR		Jan 80
E. United States Air Forces in Europe Tactical Air Intelligence System Architecture Contract Award	* (Jun 80)	Oct 81

* Dates presented in Fiscal Year 1981 Descriptive Summaries.

Explanation of Milestone Changes: C: Six month slip due to late Government Furnished Equipment delivery (3 months) and Preliminary Design Review changes (3 months). E. Delayed to take advantage of operational tests in Europe during the first quarter of FY 1980.

Budget Activity: Tactical Programs #4

Program Element: #27431F Tactical Air Intelligence System Activities

TEST AND EVALUATION DATA:

1. (U) Development Test and Evaluation: The Tactical Information Processing and Interpretation System contains functionally independent segments. Each segment is developed, tested, and produced according to the segment schedule. US-430B Enhancement, Project 2390, the Imagery Processing Segment, is the only Development Test and Evaluation scheduled for Fiscal Year 1981. The US-430B Enhancement development contract award was awarded to Head Laboratories, Dayton, OH in August 1973. In 1976 the Imagery Processing segment development was cancelled to reduce system cost. In place of the Imagery Processing segment, the existing US-430B, Photo Processing and Interpretation Facility will be enhanced. The enhancement will not involve extensive developmental costs because state-of-the-art processing, printing, quality control, and pollution abatement equipment will be integrated into the required US-430B's. The enhancement will extend the US-430B's service life and provide modernized equipment to meet the Tactical Air Forces' requirements for an Imagery Processing segment. A prototype Enhanced US-430B will be assembled and tested in a Development Test and Evaluation scheduled at Bergstrom Air Force Base, TX in December 1980. The test will last approximately 60 days.

(U) The Display and Control/Storage and Retrieval segment, Project 2516, contains automated equipment and analyst's stations to provide the Combat Intelligence Center with a capability to rapidly correlate, analyze, and assess intelligence inputs. The prime contractor was System Development Corporation of Santa Monica, CA, and the subcontractor was Radio Corporation of America, Burlington, MA. Development Test and Evaluation was accomplished from June 1975 through September 1975 at Langley Air Force Base, VA.

(U) The Imagery Interpretation segment, Project 2514, contains automated equipment and communications which enable the photo interpreter to rapidly and accurately extract and disseminate information from tactical reconnaissance imagery. The prime contractor is Texas Instruments, Dallas, TX. An extended Development Test and Evaluation was conducted from August 1974 through December 1974 at Langley Air Force Base, VA. The purpose of this test was to train user personnel, resolve problems identified during the Initial Operational Test and Evaluation, evaluate the rigid auxiliary shelter, evaluate the Imagery Interpretation segment and Intelligence Data Handling System interface, and determine the capabilities of the Imagery Interpretation segment to perform additional photo interpretation. Test results were satisfactory on all items. Numerous software changes were necessary to more fully automate the exploitation of imagery without coded data blocks. Also, some software and hardware modifications were required to increase target location accuracy. The testing was completed prior to production decision and the Imagery Interpretation segment production contract was awarded in May 1977.

(U) The United States Air Forces in Europe Tactical Air Intelligence Systems Architecture, Project 2604, is an effort to improve the overall United States Air Forces in Europe Tactical Air Intelligence Systems architecture and will be accomplished in phases. Each phase will test the information processing and handling functions and determine system shortfalls that can be overcome with improved hardware and updated/revised software. There is no Development Test and Evaluation or Initial Operational Test and Evaluation associated with this project.

Budget Activity: Tactical Programs #4

Program Element: #27431P Tactical Air Intelligence System Activities

2. (U) Operational Test and Evaluation: The WS-430B Enhancement program is managed by the Air Force System Command's Aeronautical System Division. The prototype development contract was awarded to Mead Technology Laboratories, Dayton, OH in August 1978. Initial Operational Test and Evaluation will take place December 1980 through 13 February 1981 at Bergstrom Air Force Base, TX under the management of United States Air Force Tactical Air Warfare Center. The test will be conducted using normal training film flown by the 67th Tactical Reconnaissance Wing to simulate wartime tasking. The purpose of the Initial Operational Test and Evaluation is to determine the operational effectiveness and suitability (including reliability/maintainability) of the Enhanced WS-430B prototype prior to modification/enhancement of the existing WS-430B facilities. Specific areas to be investigated include: pollution control improvements, a requirement for non-conventional film reproduction, improved quality control capabilities, an increased film processing speed capability, improved design of selected shelters, an Imagery Interpreter's Report and Edit Station for Air National Guard systems, and best means for implementing the production (modification) phase (i.e., combination of user performed Time Compliance Technical Orders; depot modifications; contractor modifications). The test team will be composed of representatives from Tactical Air Command, Air Force Logistics Command, and the Air Training Command. Upon completion of the Initial Operational Test and Evaluation, the results will be evaluated, a production (modification) decision will be made, and the production (modification) phase of the program will begin. There are no future Operational Test and Evaluation plans.

(U) The Display and Control/Storage and Retrieval Initial Operational Test and Evaluation was completed at Langley Air Force Base, VA in September 1975. The purpose of the Initial Operational Test and Evaluation was to evaluate the operational effectiveness, logistics supportability, and maintainability of the Display and Control/Storage and Retrieval. The test concluded that the Display and Control/Storage and Retrieval did not provide adequate automated support to tactical intelligence functions because of excessive computer response time, an overly large and inefficiently structured data base, and inadequate software utility. Deficiencies were corrected by software and hardware improvements. In logistics supportability and maintainability this test concluded that ample spares should be procured to provide adequate replacement parts during the life of the Display and Control/Storage and Retrieval. The supportability and maintainability deficiencies are being resolved by Air Force Logistics Command and the system is projected to be fully supportable by December 1981. The Display and Control/Storage and Retrieval will not go into production; however, a second Display and Control/Storage and Retrieval was assembled from residual Marine Corps and Air Force prototype equipment and delivered in January 1980.

(U) The Display and Control/Storage and Retrieval Initial Operational Test and Evaluation revealed major deficiencies in the Display and Control/Storage and Retrieval, generally attributable to unacceptable response time of the automated data processing. The objectives of the Initial Operational Test and Evaluation were not, in general, quantified but were qualified objectives to determine suitability of automated data processing in the areas of intelligence data handling. The Initial Operational Test and Evaluation results justified this automation with the provision that response time be improved. This was accomplished through improvement of the software and the doubling of the computer

Budget Activity: Tactical Programs #4

Program Element: #27431F Tactical Air Intelligence System Activities

memory from 128 thousand words to 256 thousand words. As a result of this change, internal system responsiveness improved by a factor of 23:1. There are no future Operational Test and Evaluation plans.

(U) An operational test and evaluation of the Imagery Interpretation segment was conducted at Bergstrom Air Force Base, TX from 3 January 1973 through 3 May 1973. The Development Test and Evaluation/Initial Operational Test and Evaluation was a joint Air Force/Marine Corps effort directed by the Air Force Systems Command's Electronic Systems Division and United States Air Force Tactical Air Warfare Center. The purpose of this test was to determine the effectiveness of the Imagery Interpretation segment in a simulated operational environment. Guidance relative to operational conditions was obtained from Pacific Air Forces, Tactical Air Command, and United States Air Forces in Europe. United States Air Force Tactical Air Warfare Center conducted the testing. A test schedule was drawn up to simulate the task loadings resulting from a tactical reconnaissance squadron flying at a rate of 1.2 sorties per assigned aircraft. Test personnel were drawn from operational units and received contractor operator training. The Operational Test and Evaluation results showed that this segment had more capability than was envisioned when the concept was originated. The test also indicated that a three-shelter Imagery Interpretation segment could support all missions flown by a tactical reconnaissance squadron in a 24-hour period. The test results show that some deletion and modification to hardware, software, and operating procedures were necessary. Some of these included adding an additional supervisor's station in the Auxiliary shelter, including the computer maintenance console with each segment and making some modifications to the system software. Upon completion of Initial Operational Test and Evaluation, recommended engineering changes were made and the Imagery Interpretation system underwent an extended Development Test and Evaluation/Operational Test and Evaluation at Langley Air Force Base, VA from 12 August 1974 to 31 December 1974. The Development Test and Evaluation was conducted by the Electronic Systems Division while the Initial Operational Test and Evaluation was conducted by United States Air Force Tactical Air Warfare Center. The purpose of this test was to train user personnel, resolve problems identified during Initial Operational Test and Evaluation, and evaluate changes made since initial testing at Bergstrom Air Force Base. In addition, the Imagery Interpretation segment's ability to do third-phase interpretation was tested. The Imagery Interpretation segment hardware was relatively trouble free and experienced no failures that delayed meeting scheduled test objectives. The segment was found to be fully capable of third-phase imagery exploitation.

(U) After successful completion of the extended Development Test and Evaluation/Operational Test and Evaluation, the Imagery Interpretation prototype was deployed to United States Air Forces in Europe and integrated into the operations of the 26 Tactical Reconnaissance Wing at Zweibrücken Air Base, Germany.

(U) Budgeting action resulted in delay of production contract award until May 1977. As a result of the production delay, the contractor was forced to place new models of equipment into the shelters. In addition, in 1978, the United States Air Forces in Europe, the Pacific Air Forces, and Tactical Air Command representatives decided to incorporate tactical electronic reconnaissance ground processing functions into the Imagery Interpretation segment. Contracts were let with Texas Instruments for software changes and hardware additions to provide tactical electronic reconnais-

Budget Activity; Tactical Programs # 4

Program Element; #27431F Tactical Air Intelligence System Activities

sance mission tape processing and data link capabilities. The first three of the seven Imagery Interpretation segments will process tactical electronic reconnaissance tapes; the last four segments will process tapes and receive tactical electronic reconnaissance data link.

(U) Tactical Air Command will direct, and United States Air Force Tactical Air Warfare Center will conduct a two-phase Follow-On Test and Evaluation of the Imagery Interpretation segment to include tactical electronic reconnaissance processing. This operational test will assess the Imagery Interpretation segment operational suitability; obtain information on organization, personnel requirements, doctrine, and tactics; and refine operational cost estimates.

(U) Phase I of the Follow-On Test and Evaluation will be conducted at Bergstrom Air Force Base, TX in First Quarter of Fiscal Year 1981. It will test Imagery Interpretation functions and the simultaneous operation of tactical electronic reconnaissance tape processing. Test duration will be approximately three weeks.

(U) Phase Two will be conducted at Zweibrucken Air Base, Germany in Fourth Quarter, Fiscal Year 1981. This four-week test will concentrate on the added tactical electronic reconnaissance data link processing functions and their impact on simultaneous tactical electronic reconnaissance tape processing and Imagery Interpretation capabilities. This phase of the test will complete Operational Test and Evaluation of the Imagery Interpretation segment.

3. (U) System Characteristics:

(U) The WS-430B Enhancement performance and objectives are:

<u>Performance</u>	<u>Objective</u>	<u>Demonstrated</u>
Image Processing	20-40 feet per minute	To be tested in Fiscal Year 1981
Pollution Abatement	Reduce quantity; Reduce residual chemical levels	
Quality Control	Improve chemical management of development solutions	
Dry Printing	Provide dry printing reproduction capability	
Photo Interpreter Report and Edit Station	Provide effective and rapid means to transmit intelligence reports	
Shelter Update	Provide efficient use of available space	

Budget Activity: Tactical Programs #4

Program Element: #27431F Tactical Air Intelligence System Activities

(U) The Display and Control/Storage and Retrieval Initial Operational Test and Evaluation revealed major deficiencies in the Display and Control/Storage and Retrieval generally attributable to unacceptable response time of the automated data processing. The objectives of the Initial Operational Test and Evaluation were to determine suitability of automated data processing in the area of intelligence data handling. The Initial Operational Test and Evaluation test results justified this automation with the provision that response time be improved. This was accomplished through improvement of the software and the doubling of the computer density memory from 128 thousand to 256 thousand words. No Operational Test and Evaluation is planned for the future.

Performance

Objective

Demonstrated Capability

Simple query
Simple update
Input messages per 24 hours
Output messages per 24 hours
Plots per 24 hours
Digital data base (character capacity)
Reliability (Mean Time Between Failure)
Maintainability (Mean Time to Return)
Availability

1 minute
1 minute
1000
750
20
62 million
400 hours
30 minutes
.999

1 minute
1 minute
1000
646
20
62 million
379 hours
22 minutes
.999

Project: #2394

Program Element: #27431F

DOD Mission Area: Tactical Surveillance Reconnaissance
and Target Acquisition, #255

Title: Operational Application of Special Intelligence Systems

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

DETAILED BACKGROUND AND DESCRIPTION: An integrated, responsive command and control system is of paramount importance in assuring the security, effective control, and economical employment of United States Air Force forces identified for, or assigned to, the North Atlantic Treaty Organization.

In this wartime role, the Commander-in-Chief, United States Air Forces Europe will exercise command of the Allied Air Forces Central Europe from the in a Federal Republic of Germany. In this capacity, the commander requires processed, correlated, and integrated information from selected intelligence and operational sources to: (1) assess the status of friendly forces, enemy forces, and the battle situation; (3) Support decisions concerning allotment of air resources in the European Central Region; and (3) provide specific guidance for the employment of critical resources. The Tactical Fusion Center, was established to provide information required to meet these needs. As installed, it provides only a partial solution. The existing computer system provides limited intelligence data to the Tactical Fusion Center and supports only certain tasks, although it has the capacity to perform many more functions. Current interfaces with Battle Staff and theater information systems are basically manual. Software will be developed and equipment procured under this program to enable the computer system to receive and process a broader spectrum of the required data, and provide the information required by the Commander-in-Chief, United States Air Forces Europe for effective command and control of air operations.

RELATED ACTIVITIES: The Tactical Fusion Center was established under the program. The baseline computer system is a Digital Equipment Corporation Dual System 10, provided by the National Security Agency in FY 1977. Other related Air Force activities include Program Element 64750F, Project 1955 DoD Indications and Warning; Program Element 31025F, Intelligence Data Handling Systems; Program Element 31339F, Intelligence Communications; Program Element 27431F, Project 2517 Battlefield Exploitation and Target Acquisition; and Project 2576 Tactical Fusion Division. These programs are coordinated through a Headquarters United States Air Forces Europe Management Office. The Project will facilitate receipt and processing of data from Tactical Electronic Receiver System, GUARDRAIL, COMPASS EARS.

(U) WORK PERFORMED BY: Air Force management for the project 2394 is provided by a Program Management Office at the Electronic Systems Division, Hanscom AFB, MA, with system engineering/technical direction support being provided by the MITRE Corporation, Bedford, MA. A development contract, to baseline existing systems and identify incremental improvements to meet user requirements, is being accomplished by Martin Marietta (Prime Contractor) and System Development Corporation (Subcontractor). Preliminary information studies were performed by TRW, Redondo Beach, CA, and Radio Corporation of America, Burlington, MA.

Project: #2394

Program Element: #27415P

DOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: Operational Application of Special Intelligence Systems

Title: Tactical Air Intelligence System (TAIS) Activities

Budget Activity: Tactical Programs, #4

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A Program Office was established and two preliminary studies completed in 1977. One studied the information flow and system sizing requirements, and the other air and missile order of battle requirements. The Program Office completed a comprehensive Program Management Plan in March 1977. The software development facility at the National Security Agency was established to effect changes to the baseline computer system. The development contract was let on 26 January 1978 with Martin Marietta. A software development facility was established at Electronic Systems Division to develop and test modifications for the operational Tactical Fusion Center. The Tactical Fusion Center was technically baselined. Operational procedures were refined and performance data was baselined for the Center's communication and automated data processing equipment. Baseline functional and product specifications for the original software were prepared. A graphics generating and disseminating terminal and a Combat Operations Intelligence Center Network processor were acquired, installed, and tested. Began development of software for the Combat Operations Intelligence Center network processor. In 1979, continued development of software for the center/user interactive terminal and display. Continued software development efforts to expand the center's computer system functions and the interconnecting of this computer with supporting data base systems. Developments relating to air track correlation were completed. Development of technical data, testing and training continued. In 1980, software development for the incoming reports, Combat Operations Intelligence Center network processor and the center/user interactive terminal and displays continued. Upgrading of the central computer system continued.
2. (U) FY 1981 Planned Program: Software development for the Computer Operations Intelligence Center network processor will continue. Upgrade of message processors will continue. Software development for the center/user interactive terminal and displays will continue. Begin Command and Control Information System interface.
3. (U) FY 1982 Planned Program: Continue message processor enhancements and Combat Operations Intelligence Center network processor enhancements. Continue interface to continue Command and Control Information System task. Begin addition of air battle data enhancement. Start final tailoring of center/user enhancements and of analyst support systems. The difference between the FY 1981 and FY 1982 Descriptive Summaries are increases to compensate for inflation.
4. (U) FY 1983 Planned Program: Complete; message processor and Combat Operations Intelligence Center network processor enhancements, Command and Control Information System interface, air and ground battle data enhancement installation of analyst terminals. Complete final tailoring of center/user enhancements and of analyst support systems.
5. (U) Program to Completion: The project is to be completed in FY 1983. The difference in total program cost between the FY 1981 and FY 1982 Descriptive Summaries are increases to compensate for inflation.
6. (U) Milestones Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Project: #2394

Program Element: #27431F

MOD Mission Area: Tactical Surveillance, Reconnaissance, and Target Acquisition, #255

Title: Operational Application of Special Intelligence Systems
 Title: Tactical Air Intelligence System (TAIS) Activities
 Budget Activity: Tactical Programs, #4

7. (U) RESOURCES (\$ in thousands)

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	5,900	6,300	9,139	6,797		39,100
Procurement (Other)	998	76				4,990

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

RDT&E (PE 27415F)	5,900	6,200	8,800	6,500		38,800
Procurement (Other) (PE 27415F)	998	76				4,990

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #28008F

Title: Operational Utility Evaluation (OUE) of the
Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

DOD Mission Area: Counter Air, #221

(U) RESOURCES (PROJECT LISTING) (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2756	OUE SIMULATION	4,300 1/	7,000 2/	3,200	6,100	TBD 3/	TBD 3/
2757	OUE INSTRUMENTATION	4,300 1/	7,000 2/	3,200	-	-	16,700
		-	-	-	6,100	TBD	TBD

1/ Funded under Program Elements 64201F (Aircraft Avionics Equipment Development), 63370F (AMRAAM), and 27133F (F-16).

2/ Funded under Program Element 64201F.

3/ To Be Determined (TBD). Program Element includes funds under Project 2757 to preserve an option to conduct an OUE flight test. Based on the results of the simulation and analyses, the need for, scope of, and funding required to conduct a flight test will be determined.

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program is structured in response to Office of Secretary of Defense direction contained in Decision Coordinating Paper (DCP) #174, January 1979, developed as a result of deliberations during the Advanced Medium Range Air-to-Air Missile (AMRAAM) Milestone I review. This DCP directed an Operational Utility Evaluation (OUE) of the AMRAAM concept consisting of necessary analysis, man-in-the-loop simulation, and flight testing using methodology similar to the 1974 Joint Air Force/Navy Air Intercept Missile/Air Combat Evaluation Validation (AIM/ACEVAL). The OUE will provide information on the useability and pilot workload impact of an AMRAAM concept missile on the F-15/F-16 with various avionics suites, electronic countermeasures, threat scenarios, and engagement environments. The effectiveness of the AMRAAM concept will be assessed relative to the alternative system, the AIM-7M Sparrow.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request will support completion of the OUE analysis and man-in-the-loop aerial combat simulation and provide funds to secure long lead instrumentation and test items sufficient to preserve the option to conduct a flight test during FY 1984-1985. Cost estimates for analysis and simulation are based on Air Force Test and Evaluation Center (AFTEC) negotiated contracts (May 1980). Cost estimates for instrumentation are based on AFTEC working group studies (August 1980) using escalation of AIM/ACEVAL experimental costs.

(U) COMPARISON WITH 1981 DESCRIPTIVE SUMMARY: Not applicable.

(U) OTHER APPROPRIATION FUNDS: Not applicable.

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Program Element: #28008F

Title: Operational Utility Evaluation (OUE) of the
Advanced Medium Range Air-to-Air Missile (AMRAAM)

DOD Mission Area: Counter Air, #221

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Operational Utility Evaluation (OUE) has the objective of establishing the utility of an AMRAAM class weapon when employed in various realistic simulated air combat environments. The program was directed by the Office of Secretary of the Defense (OSD) through the AMRAAM Decision Coordinating Paper. This effort will study the effects of various missions, electronic countermeasures, multiple-target-track avionics, identification ranges, weather, and communications jamming on operational utility and pilot useability. Under project 2756 (OUE Simulation), an analysis phase will investigate possible influences of an AMRAAM type missile on engagements previously flown during the Air Intercept Missile/Air Combat Evaluation Validation (AIM/ACEVAL). In the Simulation Phase of the same project, the Air Force man-in-the-loop simulation will evaluate the utility of an AMRAAM class missile on F-15 or F-16 fighters employed against simulated enemy fighters and fighter bombers during combat air patrol and fighter sweep missions. The Navy Simulation (included in Air Force funding) will investigate F-14 employment against fighters, bombers, and air-to-surface missiles during fleet and beach-head defense missions. Successful completion of Project 2756 will provide an assessment of the utility and effectiveness of an AMRAAM class missile relative to the current alternative system, the AIM-7M semiactive radar guided Sparrow. Based on the results of the OUE ground simulation, the requirement for and extent of any flight simulation testing will be established. Project 2757 (OUE Instrumentation) will provide long lead test items required to interface F-15 and F-16 aircraft with Utah Test and Training Range (UTTR) instrumentation order to preserve the OSD mandated option to flight test the operational utility of AMRAAM once the results of the OUE simulation are assessed. The option to flight test beginning in 1984 may be exercised if analysis and simulation results are adjudged to require flight test excursions in order to adequately answer utility concerns. This project will develop engineering solutions to provide aircraft radar, infrared, and countermeasures data interfaces with the UTTR Time-Space-Position-Indicator range instrumentation in order to provide real-time simulated weapons flyouts. Due to the avionics implications, the Operational Utility Evaluation was initiated under Program Element 64201F (Aircraft Avionics Equipment Development). However, with the addition of funds in Fiscal Year 1982 and Fiscal Year 1983 for expanding a range and procurement of long lead items to preserve an option to conduct an Operational Utility Evaluation flight simulation, the Operational Utility Evaluation effort exceeds the scope of Program Element (PE) 64201F. Beginning with Fiscal Year 1982, funding for the Operational Utility Evaluation and range upgrade is in this program element and PE 78019F, Utah Test and Training Range, respectively.

(U) RELATED ACTIVITIES: The AMRAAM Utility Evaluation is related to the AMRAAM development and acquisition program being conducted under PE 63370F (Validation) and PE 64314F (full scale development). Funding for specific range upgrades on the Utah Test and Training Range required to preserve the flight test option is included in PE 78019 (\$10M in Fiscal Year 1982, \$13.1M in Fiscal Year 1983). Funding for the Navy portion of the OUE is in PE 28008N.

Program Element: #28008F

DOD Mission Area: Counter Air, #221

Title: Operational Utility Evaluation (OUE) of the
Advanced Medium Range Air-to-Air Missile (AMRAAM)
Budget Activity: Tactical Programs, #4

(U) WORK PERFORMED BY: Government: Tactical Fighter Weapons Center Operations Analysis, Nellis Air Force Base, NV; Air Force Test and Evaluation Center, Kirtland Air Force Base, NM; Commander Operational Test and Evaluation Force, Naval Air Station (NAS) Norfolk, VA; Naval Air Development Center, NAS Patuxent River, MD; Contractors: McDonnell Douglas Corporation, St. Louis, MO; VEDA Corporation, Las Vegas, NV.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In January 1979 the Air Force was directed to present a plan to the Office of Secretary of Defense for the accomplishment of an operational concept test entitled the Operational Utility Evaluation of AMRAAM. The plan was forwarded in May 1979, and in August 1979 the Air Force was directed to begin work on the analysis and simulation phase. Contract go-ahead to Veda Corporation for analysis and McDonnell Douglas Corporation for aerial combat simulation was given in May 1980. Analysis data base tapes were constructed on selected Air Intercept Missile/Air Combat Evaluation Validation (AIM/ACEVAL) engagements. Simulation hardware was integrated to provide four F-15 or F-16 cockpit simulations. Prototype control stations for eight threat aircraft were proofed. Dynamic earth-sky and weather simulations were developed and multiple-target-track radars were integrated for the F-15. Work began on initial employment and system operational concepts for inclusion in pilot handbooks.

2. (U) FY 1981 Program: Analysis runs on the AIM/ACEVAL data tape will begin. Concentration will be on engagements that could have been influenced by the speed, range, or launch and maneuver capabilities of AMRAAM. Data will be compiled and analyzed for presentation to the Defense System Acquisition Review Council (DSARC) at AMRAAM Milestone II in November 1981. The simulation effort will continue to develop the testbed to include F-16 multiple-target-track radar, enemy electronic countermeasures and communications jamming. Final government inputs of cockpit equipment, threat data and missile kill probabilities are scheduled for January 1981. Simulator verification will begin in early March 1981 with formal testing to begin in April 1981. Approximately 2000 data trials will be accomplished and analyzed for presentation at the AMRAAM Milestone II.

3. (U) FY 1982 Planned Program: Two additional simulator test periods are planned in March and May 1982 to investigate excursions on the basic scenarios analyzed for the AMRAAM Milestone II. Preliminary candidate investigations include varied scenarios and advanced threats. This will complete man-in-the-loop aerial combat simulation. Work will begin at the Air Force Test and Evaluation Center to define range and aircraft instrumentation interface requirements for any required flight simulation testing.

4. (U) FY 1983 Planned Program: Hardware development and integration of aircraft instrumentation with the High Accuracy Multiple Object Tracking System at the Utah Test and Training Range (UTTR) Hill Air Force Base, UT, will be continued.

5. (U) Program to Completion: Integration of instrumentation with UTTR will be completed. If required, selected flight test scenarios will begin in early 1984 to provide information at the AMRAAM Milestone III in early 1985.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 28010F Title Joint Tactical Communications (TRI-TAC)
 DOD Mission Area: Tactical Communications, #256 Budget Activity Tactical Program, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
	TOTAL FOR PROGRAM ELEMENT	27,962	16,700	29,100	35,700		
2260	Tactical Communications Control Facility	13,862	8,400	21,700	30,800		
2264	Digital Nonsecure Voice Terminal	2,900	1,800	--	--		
2266	Digital Troposcatter Terminal	5,100	1,600	500	--		
2267	Test	1,300	1,400	2,500	1,900		
2270	Support	4,800	3,500	3,800	3,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The objective of this program is the development of secure anti-jam digital communications equipment for use in a tactical environment. Equipment developments center around trunking and switching equipment, system control facilities, local distribution equipment, terminal devices, and inter-face equipment. The effort seeks to achieve economy through joint participation and centralized acquisition of tactical equipment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program will continue the support of the Full Scale Development of the Communications System Control Element (CSCE) and testing of the Communications Nodal Control Element (CNCE). The CSCE and CNCE are elements of the Tactical Communications Control Facility (TCCF) Program. The Digital Troposcatter Terminal will begin production starting in FY 1981 and the Digital Non-secure Voice Terminal (DNVT) will continue in Full Scale Development. The Air Force will continue support of the TRI-TAC Joint Test Facility at Ft. Huachuca, AZ. The DNVT will begin production in FY 1982. The cost estimates were provided by the Program Office at Electronic Systems Division.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
RDT&E Procurement (Other)	28,400 4,800	16,768 47,000	23,749 108,000			
OTHER APPROPRIATION FUNDS:						
Procurement (Other)	4,300	40,303	93,908	78,997		

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Program Element: #28010F

DOD Mission Area: Tactical Communication #256

TITLE: Joint Tactical Communications (TRI-TAC)
Budget Activity: Tactical Program #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Joint Tactical Communications Program (TRI-TAC) is a Department of Defense directed joint service effort to develop and acquire communications equipment for the tactical forces. The program addresses tactical communications requirements in the areas of trunking and switching; systems control facilities, local distribution equipment, terminal devices, and interfaces. The efforts seek to achieve economy through joint participation and centralized acquisition of tactical equipments. The program includes certain systems analyses, cost effectiveness studies, and research and development to integrate service requirements and TRI-TAC developed concepts and equipments. Improvements are required in communications switching and high speed transmission capabilities to achieve high speed, digital, secure communications in the 1980's. The Air Force effort is known as the Combat Theater Communications Program (CTCP). The Air Force effort includes full scale development of the Communications Nodal Control Element (CNCE) and the Communications System Control Element (CSCE). The CNCE and CSCE provide technical control and system management functions for the TRI-TAC switching and transmission equipment. The Digital Troposcatter Terminal (TROPO), which is in full scale development, will provide long range wideband communications in a tactical environment. The Digital Nonsecure Voice Terminal will provide terminal capability for voice where secure voice is not required. This device is in the full scale development phase.

(U) RELATED ACTIVITIES: Program Element 28010F is conducted by all the Services under the overall direction of the office of Assistant Secretary of Defense, Command, Control, Communications and Intelligence, and the guidance of the TRI-TAC Office, Fort Monmouth, NJ. It is related to programs within the Defense Communications System which are more "strategic communications" oriented and to programs within National Security Agency for communications security resources. The objective is to ensure sufficient coordination to prevent duplication of effort and to permit standardization of interfaces where feasible.

(U) WORK PERFORMED BY: The Air Force Systems Command manages the Air Force portion of this program through the Electronics Systems Division, Hanscom AFB, MA, and Rome Air Development Center, Griffiss AFB, NY. Current contractors include: Martin-Marietta Corporation, Orlando, FL (TCCF); Raytheon, Sudbury, MA (TROPO); ECI, St. Petersburg, FL (DNVT); Analytical Systems Engineering Corporation, Burlington, MA (Support); and MITRE Corporation, Bedford, MA (Support).

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Development contract for the Tactical Communications Control Facility was awarded in May, 1975, and the contract for the Digital Troposcatter Terminal was awarded in June, 1976. Both are now undergoing in-plant Contractor Development Testing (CDT). A validation contract for the Digital Nonsecure Voice Terminal was completed in 1978. The Air Force has provided support (Project 2267) for the TRI-TAC Joint Test Facility at Ft. Huachuca, AZ. Project 2270 provides engineering support for the Combat Theater Communications Program at Hanscom AFB, MA. One CNCE (one of three) and one digital troposcatter radio were delivered to the Joint Test Facility at Ft. Huachuca, AZ in May, 1979 to begin Service testing. The contractor delivered the remaining two Digital Troposcatter Terminals in May, 1979. Service testing was completed in October, 1980. Developmental testing of the CNCE began in June, 1980, and will continue until April, 1981. Operational testing will begin in April 1981 and will continue until September 1981.

Program Element: #28010F

DOD Mission Area: Tactical Communications #256

Title: Joint Communications (TRI-TAC)

Budget Activity: Tactical Program #4

2. (U) FY 1981 Program: Production contract for the Digital Troscatter Terminal (TROPO) is expected to be awarded in July, 1981. The Digital Nonsecure Voice Terminal began full scale development in July, 1980. The CNCE continues in full scale testing.
3. (U) FY 1982 Planned Program: The CNCE will complete service testing. Evaluation of the testing will be completed by both the developing command and the Air Force Test and Evaluation Center. Pre-production planning will continue and preparations will be completed for the Defense Systems Acquisitions Review Council (DSARC). The TROPO will continue in production. The Digital Nonsecure Voice Terminal production contract is scheduled to be awarded in August, 1982. The CSCE full scale engineering development contract is planned to be awarded during this period. No significant change in total Program Element until FY 1982. Change this year due to approximately \$5M RDT&E funds added by OSD for development of the Communications System Control Element.
4. (U) FY 1983 Planned Program: The Full Scale Development (FSD) of the Communications System Control Element will continue with emphasis on the development of applications software, and a low rate production effort will begin. The Troscatter Terminal will continue in production.
5. (U) Program to Completion: The Communications System Control Element will continue FSD into FY 1985. All other items currently in the overall Air Force program will complete development by the mid 1980's.

6. (U) Milestones:

Communications Nodal Control Element

Contract Award
Preliminary Design Review - Hardware
Preliminary Design Review - Software
Critical Design Review - Hardware
Critical Design Review - Software Part I

Part II

Contractor Development Testing
Variant Development
Software Delivery
Service Testing Began
DSARC III
Production Begins

Communications System Control Element

RFP Release
Contract award
Developmental and Operational testing

May 1975
Dec 1975
Aug 1976
Apr 1977
Aug 1977
Jan 1978
Sep 1977 - Dec 1978
Jul 1979 - Dec 1982
Jun 1980
Aug 1980
Oct 1982
Dec 1982

Mar 1981
Jan 1982
May 1985 - Nov 1985

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Program Element: #28010F

DOD Mission Area: Tactical Communication #256

Title: Joint Tactical Communications (TRI-TAC)

Budget Activity: Tactical Program #4

Digital Troposcatter Terminal

Contract Award	Jun 1976
Preliminary Design Review	Feb 1977
Critical Design Review	Aug 1977
Delivery	May 1979
Service Testing Complete	Oct 1980
Production Decision	Apr 1981
Production Begins	Jul 1981

Digital Nonsecure Voice Terminal

Validation Phase Contract Award	Jun 1976
Validation Effort Complete	Sep 1977
Developmental Suitability Testing	Sep 1977-Sep 1978
Full Scale Development Contract Award	Jul 1980
Service Testing	Oct 1981-Feb 1982
Production Begins	Aug 1982

Budget Activity Tactical Programs, #4

Program Element #28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

1. (U) Development Test and Evaluation: The Joint Tactical Communications (TRI-TAC) program is a joint Service program with each Service responsible for the development of assigned equipment. The United States Air Force has been assigned four items; the Tactical Communications Control Facility is a major item. This report presents the overview. Each Service and National Security Agency is also responsible for the development, test and evaluation of equipments tasked by the Department of Defense. Individual test plans including interface parameters are coordinated with the TRI-TAC Office. Initial developmental testing will be conducted in-plant by the developing contractor. Developmental Testing and Evaluation will include hardware integration testing, Communications Security, integration, reliability and maintainability, and acceptance testing of peripheral equipment. Joint developmental and initial operational testing of Air Force developed TRI-TAC equipments was initiated in June, 1979 by the Joint Test Organization at Fort Huachuca, Arizona. The contractor for the Tactical Communications Control Facility is Martin-Marietta, Orlando, FL. The Raytheon Co., Sudbury, MA is the prime contractor for the Digital Troposcatter Terminal. The contractors for the Digital Nonsecure Voice Terminal are Magnavox and E-Systems.
2. (U) Operational Test and Evaluation: TRI-TAC test and evaluation is being conducted as a multiservice combined development test and evaluation/initial operational test and evaluation program. The acquisition service/ agency has overall responsibility for operational test and evaluation of each of the TRI-TAC equipments. Full-scale engineering development models of each TRI-TAC equipment will be operated and maintained by Army, Navy, Marine Corps, and Air Force personnel during initial operational testing. These personnel are selected from the using commands and agencies on the basis of specialty codes expected to be used during operational equipment deployment. Testing will be conducted primarily at Fort Huachuca, Arizona, with some interface testing planned at Hurlburt Field, Florida, and Naval facility in San Diego, California.
- (U) The Air Force Test and Evaluation Center has operational test and evaluation responsibility for the Short-Range Wideband Radio, Digital Nonsecure Voice Terminal, Digital Troposcatter Radio Terminal (AN/TRC-170), and the Tactical Communications Control Facility. The Tactical Communications Control Facility comprises the Communications Nodal Control Element and the Communications System Control Element.
- (U) The Short Range Wideband Radio development has not been funded. Therefore test planning for this program has been deferred pending further direction.
- (U) The Digital Nonsecure Voice Terminal full-scale development contract awards were made in July 1980 to Magnavox Electronics and E-Systems, Incorporated Joint developmental/operational testing is scheduled for the period August through November, 1981. Initial operational test planning will begin in late 1980 in coordination with the United States Army Operational Test and Evaluation Agency, United States Naval Operational Test and Evaluation Agency, United States Marine Corps Operational Test and Evaluation Activity, National Security Agency, Defense Communications Agency, and United States Air Force using and supporting commands. Production contract is scheduled for January, 1982.

Budget Activity Tactical Programs, #4

Program Element #28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

(U) The AN/TRC-170 initial operational testing objectives address radio performance, error rates, voice intelligibility, intraoperability, communications security, survivability, compatibility, safety, human engineering, electronic warfare, reliability, availability, maintainability, logistics supportability, mobility, and transportability. A combined developmental/operational test was conducted from June, 1979, to October, 1980. The first initial operational test was conducted in December, 1979 with a separate initial operational testing during the last two months. In addition to separate initial operational testing periods, the Air Force Technical Evaluation Center initial operational test team actively participated in developmental testing conducted by Air Force Systems Command. The production decision is scheduled for April, 1981.

(U) The Communications Nodal Control Element initial operational testing plan is currently being coordinated with all service test agencies, the National Security Agency, the Defense Communications Agency, and the Air Force using and supporting commands. Joint developmental/operational testing is scheduled from June, 1980 through July 1981. Defense Systems Acquisition Review Council milestone III is scheduled in October 1981.

(U) The Communications System Control Element program is currently being restructured and redefined. Milestone dates are not available. Initial operational test planning will commence after the program is defined and firm schedules are available.

(U) The United States Army Operational Test and Evaluation Agency has operational test and evaluation responsibility for the AN/TYC-39 message switch, AN/TTC-39 circuit switch, digital group multiplexer, mobile subscriber equipment, mobile record traffic terminal, and net radio interface. Air Force Technical Evaluation Center is participating in testing and test planning for those TRI-TAC equipment items which are programmed to enter the Air Force Inventory. There was no Air Force participation planned for the Net Radio Interface or Mobile Subscriber initial operational testing.

(U) Four AN/TYC-39 message switches were tested from 15 February, 1979, through 15 June, 1979. Although deficiencies existed, the AN/TYC-39 has the potential to provide a significant improvement in message throughput, decreased operator workload, and message traffic accounting. Defense Systems Acquisition Review Council milestone III was in March, 1980, and recommended production of the AN/TYC-39. The Air Force Technical Evaluation Center report was dated October, 1979.

(U) Four AN/TTC-39 circuit switches were tested from 13 November, 1979, to 20 May, 1980. Although deficiencies were discovered, the AN/TTC-39 performed well enough for the July 1980 Defense Systems Acquisition Review Council milestone III to recommend production. Because the software tested in the AN/TTC-39 was not the software to be procured, there will be additional testing from November, 1980, to February, 1982, to test the operational software. The Air Force Test and Evaluation Center report is dated August, 1980.

(U) Digital Group Multiplex equipment is currently being tested as integral parts of other individual TRI-TAC equipments. In addition, a separate Digital Group Multiplex initial operational testing and evaluation is being conducted from August until October, 1980. This initial operational testing will address issues not satisfied by other test programs. The production decision is scheduled for May, 1981.

Budget Activity Tactical Programs, #4

Program Element #28010, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

(U) The National Security Agency has test and evaluation responsibility for all communications security items being procured in the TRI-TAC programs. Except for the communications security equipment associated with the Advanced Narrowband Voice terminal, separate periods of initial operational testing and evaluation are not planned. The communications security equipment items are being tested in conjunction with intraoperability, interoperability, and communications security tests conducted during initial operational testing and evaluation of the parent equipment (e.g., AN/TYC-39, Nodal Control, Advanced Narrowband Digital Voice Terminal, etc.).

(U) The United States Marine Corps Operational Test and Evaluation Activity has operational test and evaluation responsibility for the Unit Level Switch program. The Unit Level Switch comprises three equipment items: an AN/TTC-42 Unit Level Circuit Switch, an SB-3865 switchboard, and an AN/GYC-7 Unit Level Message Switch. There are no Air Force plans to procure the AN/GYC-7. The AN/TTC-42 and SB-3865 will be simultaneously tested at the Fort Huachuca test bed. The Air Force Test and Evaluation Center is participating in initial operational test plan development with the Marine Corps Testing Agency, and Initial Operational Test & Evaluation is currently scheduled for August, 1982 through December, 1982. A production decision is scheduled for April, 1983.

(U) The United States Naval Operational Test and Evaluation Agency has operational test and evaluation responsibility for the Tactical Digital Facsimile and the Advance Narrowband Digital Voice Terminal.

(U) The Tactical Digital Facsimile initial operational testing and evaluation is scheduled for March, 1981 through April, 1981. The Air Force Test and Evaluation Center is participating in the test plan development with the United States Naval Operational Test and Evaluation Agency. The test objectives address operational performance, survivability, reliability, availability, maintainability, logistics supportability, mobility, transportability, training, human factors, safety, interoperability and operational security. A production decision is scheduled for August, 1981.

(U) The Advanced Narrowband Digital Voice Terminal is in the full scale engineering development phase. The Air Force Test and Evaluation Center will participate in operational test plan development with the United States Naval Operational Test and Evaluation Agency. Initial operational testing and evaluation is scheduled from November, 1983 through April, 1984. Initial operational testing and evaluation of the communications security equipment associated with the Advanced Narrowband Digital Voice Terminal is scheduled from August 1982 to May, 1983. A production decision is scheduled for June, 1984.

Budget Activity Tactical Programs, #4

Program Element #28010F, Joint Tactical Communications (TRI-TAC)

Test and Evaluation

3. (U) System Characteristics:

EQUIPMENT	DESCRIPTION										
Tactical Communications Control Facility (Consists of Communications Nodal Control Element, Communications System Control Element)	<ul style="list-style-type: none">• Provides automated technical control facilities for<ul style="list-style-type: none">- Node Control & Management- Line conditioning & interface- Performance monitoring- Rerouting- Record keeping- Directory control• Family of modular digital Tropo terminals										
Troposcatter Terminals	<table><tr><th>Power</th><th>Range</th></tr><tr><td>• Type 1 10 Kilowatts</td><td>200 miles</td></tr><tr><td>• Type 2 1.5 Kilowatts</td><td>100-200 miles</td></tr><tr><td>• Type 3 .66 Killo Watt</td><td>0-100 miles</td></tr><tr><td>• Data Rate 2.048 Megabits/second</td><td></td></tr></table>	Power	Range	• Type 1 10 Kilowatts	200 miles	• Type 2 1.5 Kilowatts	100-200 miles	• Type 3 .66 Killo Watt	0-100 miles	• Data Rate 2.048 Megabits/second	
Power	Range										
• Type 1 10 Kilowatts	200 miles										
• Type 2 1.5 Kilowatts	100-200 miles										
• Type 3 .66 Killo Watt	0-100 miles										
• Data Rate 2.048 Megabits/second											
Digital Nonsecure Voice Terminal	<ul style="list-style-type: none">• Digital Telephone• Continuously variable slope delta modulation• 4 wire common battery• Electrically compatible with TRI-TAC secure telephone										

Project: #2260

Program Element: #28010F

DOD Mission Area: Tactical Communications, #256

Title: Tactical Communications Control Facility

Title: Joint Tactical Communications (TRI-TAC)

Budget Activity: Tactical Programs, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The Communications System Control Element (CSCE) and Communications Nodal Control Element (CNCE) are elements of the Tactical Communications Control Facility (TCCF). The CSCE is management-oriented and will provide real time monitoring and data base maintenance of communication network status and near real time control over the allocation and use of resources within a deployed tactical communications network. Resources at the node will be assigned, monitored, controlled and managed for users by the CNCE. The hardware and the software within the CSCE and CNCE provide support to the TTC-39 family of switches being developed by US Army.

(U) RELATED ACTIVITIES: The TCCF is an element of an integrated tactical communication system and is related to all other elements of the TRI-TAC system.

(U) WORK PERFORMED BY: The specification for the CSCE is being written by a joint-service team, and a competitive contract is planned to be awarded in FY 1982. The full scale development of the CNCE continues on contract with Martin-Marietta of Orlando, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A contract was awarded in May 1975 to Martin Marietta Corporation, Orlando, FL, for the full scale development of the CNCE and the validation phase of the CSCE. Preliminary design review for the hardware on the CNCE was completed in December 1975. The full scale development effort has continued with emphasis on the applications software development for the CNCE. Contractor development testing of the Type III (single shelter) CNCE began in early FY 1978. Developmental testing of the type I (dual shelter) CNCE began in Aug, 1980, and will continue until September, 1981.
2. (U) FY 1981 Program: The CNCE will continue in testing.
3. (U) FY 1982 Planned Program: The CNCE Variant (expanded capacity version) will continue in full scale development. Evaluation of the test results will be completed by the development command (Air Force Systems Command), Air Force Test and Evaluation Center and representatives of the other participating services (Army, Navy, Marine Corps). The full scale development of the CSCE will begin.
4. (U) FY 1983 Planned Program: Same as FY 1982 program.
5. (U) Program to Completion: Full scale development of the CSCE should be completed in FY 1985. Both versions of the CNCE will be in production by FY 1985.
6. (U) Milestones: See previous chart.

Project: #2260

Program Element: #28010F

DOD Mission Area: Tactical Communications, #256

Title: Tactical Communications Control Facility

Title: Joint Tactical Communications (TRI-TAC)

Budget Activity: Tactical Programs, #4

7. (U) Resources:

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Estimated Costs</u>
RDT&E	13,529	8,400	21,700	30,800	Continuing	Not Applicable
8. (U) <u>Comparison with FY 1981 Budget Data:</u>						
RDT&E	15,265	8,468	16,549		Continuing	Not Applicable

No significant change in total Program Element until FY 1982. Change this year due to approximately \$5M RDT&E funds added by OSD for development of the Communications System Control Element (CSCE).

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 35887F

DOD Mission Area: Strategic Communications, # 133

Title: SIMVAL

Budget Activity: Tactical Programs, # 4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs Not Applicable
TOTAL FOR PROGRAM ELEMENT							
			1,400		1,200	Continuing	

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element provides funding and manpower to validate radar threat simulators used for aircrew training, plus Electronic Warfare equipment development and testing. The United States Air Force has 200 plus fielded radar threat simulators requiring validation to insure Electronic Countermeasures and threat warning equipment are being developed and tested against a current threat radar environment. During development, threat simulators also require periodic interval validation. Respectively, Foreign Technology Division and Air Force Electronic Warfare Center will validate threat simulators under development and those already fielded.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Foreign Technology Division (FTD) at Wright Patterson AFB, Ohio has been responsible for producing intelligence packages for validation and for validating only new threat radar simulators in development since 1976. This contract has been an on-going contract since first negotiated in 1976. This new program element 35887F has consolidated contract monies (\$1,400K) for threat simulator validation from PE's which previously funded SIMVAL (64738F and 64735F). The Threat Simulator Working Group did a cost analysis study on a prioritized group of simulators. After minimizing all costs, the group finalized the estimate figures.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY

FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs

RDT&E (Not Applicable)
Procurement (Not Applicable)

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)	313	315	Continuing	Not Applicable
Operation and Maintenance	1,075	1,534	Continuing	Not Applicable

1099

1099

Title: SIMVAL
Budget Activity: Tactical Programs, # 4

Program Element: # 35887F
DOD Mission Area: Strategic Communications, #133

DETAILED BACKGROUND AND DESCRIPTION:

(U) RELATED ACTIVITIES: Operational Test and Evaluation, Design Test and Evaluation, Research and Development, and Flight Test Range Activity.

(U) WORK PERFORMED BY: BDM Corporation Albuquerque, New Mexico has contract for validation of new simulators as they are being developed. Their branch office located at the Foreign Technology Division (FTD), Wright Patterson Air Force Base, Ohio, performs the actual validations. The current contract was negotiated in 1976 and these 3600 monies will continue to pay for this contract assistance. These validations require extensive TDY to evaluate simulators at their current locations throughout the United States.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS: Not Applicable.

1. (U) FY 1980 and Prior Accomplishments:

Program Element: # 35887F

DOD Mission Area: Strategic Communications, # 133

Title: SIMVAL

Budget Activity: Tactical Programs, # 4

2. (U) FY 1981 Program: Not applicable.

3. (U) FY 1982 Planned Program: A classified consolidated prioritized threat simulator list (200 simulators) has been developed by FTD, AFWC and simulator users. The FY 82 program will validate the first 20 simulators.

4. (U) FY 1983 Planned Program: The classified list of prioritized threat simulators will be evaluated again before FY 83; but current plans are to validate 20 more simulators from the overall list of 200.

5. (U) Program to Completion:

This program will be an on-going effort at the rate of 20 currently fielded simulators per year. In addition, new simulators as they are being developed will require validation at specific milestones during the development cycle.

6. (U) Milestones: Not applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #41115F
DOD Mission Area: Airlift, #261

Title: C-130 Airlift Squadrons
Budget Activity: Tactical Programs, 4

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		9,000	15,000			24,000

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force special operations forces are designed to support unified command requirements during

Two dozen C-130s have been modified over the past several years with additional equipments which make them uniquely qualified for a range of special operations. One shortfall remaining is the ability to operate out of short, austere landing areas. The activities have precipitated this urgent program to test specific aerodynamic and avionics improvements on a C-130 to provide a short takeoff and landing (STOL) capability.

BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 program is a continuation of the FY 1981 supplemental budget effort to conduct flight tests of a previously modified C-130. Aerodynamic changes which will be tested include extended ailerons, high lift flaps, and larger vertical (dorsal) and horizontal (horsal) stabilizing surfaces. An avionics package which integrates infrared, laser, and radar information into a self contained capability for short field landings conditions will also be tested. Funds are included for subsequent aircraft demodification. The program is scheduled to start in July 1981 and span approximately twelve months, including aircraft demodification.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable.
This program is a new initiative in the FY 1981 supplemental budget.

(U) OTHER APPROPRIATION FUNDS:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Procurement: (Aircraft) (PE #27241F) (Quantity)			33,300 (Long Lead, 4)	TBD	TBD	TBD

1007A

Program Element: #41115F

DOD Mission Area: Airlift, #261

Title: C-130 Airlift Squadrons

Budget Activity: Tactical Programs, 4

DETAILED BACKGROUND AND DESCRIPTION: The objective of this program is to test and refine short takeoff and landing (STOL) technology options which can be incorporated on USAF special operations C-130 aircraft. This effort is just one of several recent initiatives for improving the Air Force's capability in this mission area. Many potential scenarios utilize helicopters at the critical terminal locations when landing and takeoff space is limited. This STOL C-130 concept has, however, unique advantages in terms of. In addition to the C-130 flying twice the speed of a helicopter (surprise and time factor), the payload can be larger and involve fewer aircraft (coordination and training factors). These are important considerations in areas remote from US bases. The aerodynamic changes are anticipated to significantly reduce stall speeds and enhance stability, control, and flying qualities at the lower flying speeds associated with. Equally important is the capability to land without and tests of an integrated flight director/autopilot and sensor display system will also be conducted.

(U) RELATED ACTIVITIES: Aircraft procurement funds for long lead materials have been included in the FY 1982 amended budget for a follow-on program identified as MC-130H, PE #27241F. The MC-130H program provides for twelve aircraft to satisfy recently revealed shortfalls in the size and capability of our special operations force. STOL capabilities developed and tested under this RDT&E program are planned to be incorporated in the MC-130H program.

(U) WORK PERFORMED BY: Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio is responsible for the management of this program. Principal contractors are: Lockheed-Georgia Company, Marietta, Georgia; International Business Machines, Federal Systems Division, Owego, New York; and Texas Instruments, Incorporated, Dallas, Texas.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable.
2. (U) FY 1981 Program: Conduct flight tests of the aerodynamic changes to obtain parametric performance data. Test nonintegrated, avionics package and design integrated flight director/autopilot and sensor display system. Aircraft to be used was originally configured for another purpose.
3. (U) FY 1982 Planned Program: Install and test the integrated, self contained landing avionics. Refine and conduct additional aerodynamic tests. Late in the fiscal year, the temporary modifications to the aircraft will be removed and the aircraft returned for normal airlift operations.
4. (U) FY 1983 Planned Program: Not Applicable.
5. (U) Program to Completion: Not Applicable.
6. (U) Milestones: Not Applicable.

10078

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 41119F
DOD Mission Area: Airlift, #261

Title: C-5A Airlift Squadrons
Budget Activity: Tactical Programs, #4

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
410A	TOTAL FOR PROGRAM ELEMENT	12,950	11,000	15,900	13,700	12,000	188,650
	C-5A WING MODIFICATION PROGRAM	12,700	11,000	15,900	13,700	12,000	188,400

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The C-5A provides rapid worldwide airlift of personnel and supplies in support of DOD and national missions. It represents the only aircraft in the strategic mobility force capable of airlifting large "outsized" cargo. The Wing Modification will insure the future availability of the C-5 force by providing improved wing life compatible with the remaining life of the non-wing structure of the aircraft.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Cyclic testing of the fatigue test wing to the second lifetime of 60,000 cyclic test hours will be completed by April 1982. Damage tolerance testing will begin after the fatigue article is inspected and the second lifetime report completed. The Follow-On Operational Test and Evaluation flight test program will be completed by February 1982 and the results will be reported. Cost estimates were validated by an Independent Cost Assessment completed in October 1979 in support of Milestone III and are based upon a negotiated contract with Lockheed-Georgia Company.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	12,700	11,098	15,200		24,537	186,671
Procurement (aircraft)	85,400	166,700	181,800		398,000	851,900

(U) OTHER APPROPRIATION FUNDS:

Procurement (aircraft) (Quantity)	87,700 (4)	166,700 (12)	192,500 (18)	190,700 (18)	243,400 (24)	881,000 (76)
Operation & Maintenance (Program Element #72207F) (Install Quantity)			55,500 (5)	101,500 (15)	319,900 (56)	476,900 (76)

1103

Project: # 410A

Program Element: #41119F

DOD Mission Area: Airlift, # 261

Title: C-5A Wing Modification

Title: C-5 Squadrons

Budget Activity: Tactical Program, #4

(U) DETAILED BACKGROUND AND DESCRIPTION: The C-5A aircraft cannot achieve its design service life of 30,000 hours with its current wing. The safe life limit of the current wing has been assessed as 7100 Representative Mission Profile hours. Discovery of inherent design and materials deficiencies in the C-5A wing structural components date back to the first failure of the static test article in 1969, and a second failure in 1971. In addition, experience gained from testing of two fatigue test articles indicates that the wing service life is far short of its design goal. In 1972 an Independent Review Team of highly qualified engineering talent was formed to examine all aspects of the C-5 structure. After a year's study, it concluded that, except for the wing, the C-5 structure should be capable of attaining 30,000 hours of service life. The team provided a range of options to increase the life of the aircraft and, from these options the Air Force selected the current modification program which has evolved to total replacement of the center, inner, and outer wing boxes which are the load carrying structural component of the wing. The approach in the design of the new structure is to reduce stress levels in the wing by the addition of necessary material. The material to be used in the new boxes is a different alloy possessing greater fracture toughness. By installing the longer life wing, the availability of the C-5A to the strategic mobility forces is assured beyond the year 2000 time frame.

(U) RELATED ACTIVITIES: The C-5A force is being managed by the Military Airlift Command and by San Antonio Air Logistics Center to assure that wing life limits will not be reached prior to the scheduled modification program input dates. This effort involves individual aircraft flying time management, payload limitations and mission profile restrictions.

(U) WORK PERFORMED BY: The design and development testing is being managed by the Aeronautical Systems Division of Air Force Systems Command. A contract for the design and testing was awarded to the Lockheed-Georgia Company, Marietta, GA in December 1975. A production contract for the fabrication and installation of the replacement wing box components for the 76 unmodified aircraft was awarded to Lockheed-Georgia Company in July 1980. Avco of Nashville, TN, was a major subcontractor for the fabrication of the two test "kits" and will fabricate major sections of the production components.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In December 1975 a contract was awarded to the Lockheed-Georgia Company for the design of the wing modification for the C-5A aircraft. Options for the fabrication and testing of two prototype wing modification kits were exercised in January 1977 with the release of long lead materials for the kits. The wing modification design was completed in June 1978. Fabrication of the two test kits was completed in October 1979. The fatigue article was fully assembled in July 1979 and the strain survey was successfully completed in August 1979. Cyclic testing of the fatigue article started in August 1979. Work was completed in May 1980 to install the second kit into the flight test aircraft and flight testing began in August 1980. The fatigue test reached the first lifetime of cyclic testing (30,000 hours) in May 1980 and testing continued throughout the end of the year. Fabrication of the first increment of production kits was initiated in August 1980 subsequent to the Milestone III production decision in June 1980 and contract award in July 1980.

2. (U) FY 1981 Planned Program: The limited development flight test will be completed in December 1980; the aircraft will be deinstrumented and returned to the Military Airlift Command for follow-on testing. The fatigue article will continue with the second lifetime of cyclic testing. Without major failures of the test article, the 60,000 test hours could be reached as early as June 1981. Fabrication of the first production kits will continue.

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Project: #410A

Program Element: #41119F

DOD Mission Area: Airlift, #261

Title: C-5A Wing Modification

Title: C-5 Squadrons

Budget Activity: Tactical Programs, #4

3. (U) FY 1982 Planned Program: Cyclic testing to the second lifetime or to 60,000 cyclic test hours will be completed by January 1982. The fatigue test article will then be inspected and evaluated before durability and damage tolerance testing is initiated. Follow-on Operational Test and Evaluation of the flight test aircraft will be complete in February 1982. Kit fabrication will continue and production line operation for the installation of the first increment of five kits will begin in February 1982 when the first aircraft is delivered to Air Force Plant Number Six operated by Lockheed-Georgia Company. Estimated costs have increased in this fiscal year by \$11.9 million which is primarily attributed to an inflation adjustment of \$9.4 million. An additional Procurement Appropriation increase of \$2.5 million was the result of contract negotiations which required funding some kit subassembly effort that was previously budgeted in the Operation and Maintenance Appropriation in later years.

4. (U) FY 1983 Planned Program: Damage tolerance testing of the fatigue article will continue throughout the year. Kit fabrication will continue with 34 kits in progress and five aircraft in the production line at the beginning of the year. The first delivery will occur in March 1983. By the end of the fiscal year eight aircraft will have been delivered and 12 aircraft along with 44 kits will be in work.

5. (U) Program to Completion: The remainder of the fatigue test program consists of residual strength testing, tear-down inspection and test results report. Fabrication and installation of the 76 production kits will complete the Wing Modification program for all 77 of the inventory C-5 aircraft. Total RDT&E estimated costs were increased by \$1.9 million as a result of inflation adjustments. Excluded from Project 410A RDT&E cost data is the addition of \$250,000 for the Congressionally Mandated Mobility Study. Total procurement costs increased by \$49.1 million which is primarily attributed to an inflation adjustment of \$28.2 million. The remaining increase of \$20.9 million was the result of contract negotiation which required the transfer of some kit subassembly funding from Operation and Maintenance to the Procurement Appropriation. This transfer realigns the program costs starting in FY 1980 in consonance with the full funding policy. It was accompanied by a \$26.4 million decrease in the Operation and Maintenance Appropriation which is part of Program Element #72207F.

Project: 410A

Program Element: #41119F

DOD Mission Area: Airlift, #261

Title: C-5A Wing Modification

Title: C-5 Squadrons

Budget Activity: Tactical Programs, #4

6. (U) Milestones:

A. Award Design Contract	December 1975
B. Exercise Fabrication and Test Options	January 1977
C. Critical Design Review	November 1977
D. Complete Wing Modification Design	June 1978
E. Strain Survey on Fatigue Article	August 1979
F. One Lifetime of Fatigue Testing Complete	*(August 1980) May 1980
G. Release of Long Lead Funding	January 1980
H. Production Program Approval (Milestone III)	*(December 1979) June 1980
I. First Flight and Start of Combined Flight Test Program	August 1980
J. Fabrication Go-Ahead for First Kit Increment	August 1980
K. Combined Flight Test Program Complete (less report and deinstrumentation)	October 1980
L. Input First Aircraft for Production Program Modification	February 1982
M. Follow-On Test and Evaluation Complete	February 1982
N. Two Lifetimes of Fatigue Testing Complete	*(June 1982) January 1982
O. Output First Modified Production Aircraft	March 1983
P. Output Last Modified Production Aircraft	July 1987
* Date presented in FY 1981 Descriptive Summary	

EXPLANATION OF MILESTONE CHANGES:

The first lifetime fatigue testing was completed early due to the absence of discrepancies during the test. The date for Milestone III review was delayed due to contract negotiations delays. Date for completion of 60,000 hours of testing revised due to ahead of schedule condition.

Budget Activity: Tactical Programs, #4
Program Element: 41119F, C-5 Squadrons

Test and Evaluation Data

1. (U) Development Test and Evaluation: A contract was awarded in December 1975 to Lockheed-Georgia Company, Marietta GA, for the design, fabrication, test and evaluation of a modification to the wings of the C-5A which will provide a 30,000 hour wing life after modification. The design approach is to lower the stress levels in the wing by a redesign which will "upsized" (add material to) the structural members. The new boxes will be fabricated from aluminum alloy 7175T73511 which offers improved fracture toughness and corrosion resistant characteristics over the 7075T6511 alloy in the present wing. The design phase included an extensive component test program to develop and verify design concept material selection, fastener selection and configuration. These efforts conducted by the contractor with support from the Air Force Materials Laboratory and the Air Force Flight Dynamics Laboratory included component strength tests, fatigue tests and damage tolerance evaluations. Members of the Air Force Scientific Advisory Board met on 12 December 1977 as the Aeronautical Systems Division Advisory Group to review the design and component test program results. The Group concluded that the new design as substantiated by the component test program provided much lower stress levels, improved fastener systems, superior materials selection in the areas of fracture toughness and stress corrosion resistance, and a number of design improvements in known critical areas. Their overall assessment was that the new design was conservative with low technical risk and that the full scale ground fatigue tests were well designed to assess the projected service life. The Directorate of Airlift Modernization, Aeronautical Systems Division of Air Force Systems Command is the program manager. The development test and evaluation phase began in January 1977 with the release of long lead material to fabricate two complete sets of test wings using production tooling. The testing of the Wing Mod design is divided into two portions, i.e., ground structural fatigue tests and flight tests.

(U) Contractor conducted and Air Force monitored structural fatigue testing was initiated in August 1979 with the completion of a strain survey. The survey verified the analysis model predicted stresses by actual stress measurement and provided additional corroboration that the stresses in the new design are significantly below those of the unmodified wing. Cyclic fatigue tests designed to demonstrate the life improvement characteristics of the redesigned components began immediately upon completion of the strain survey. The spectrum applied to the full fatigue article (X-991) is a flight-by-flight representation of the intended usage. Two minor structural defects were discovered during the first lifetime of testing. These were a crack in the radius of two aft splice fittings discovered at 29,750 test hours and cracks in four upper lobe frame clips discovered at 30,000 test hours. Both defects have been corrected by redesigning the parts which are now installed and undergoing test on the fatigue article. One and one half lifetimes of fatigue testing has been completed with no significant structural deficiencies.

(U) Concurrence addressed by a Deputy Secretary of Defense April 1976 Memo has been minimized by restricting production kit fabrication until the first of two lifetimes of fatigue testing has verified the fatigue characteristics of the modified wing. Achievement of one lifetime or 30,000 cyclic test hours of testing was successfully completed in May 1980, and was a prerequisite to the actual fabrication of new hardware, that began in August 1980. On 1-2 July 1980, the Scientific Advisory Board reviewed the first lifetime of fatigue testing results. They concluded that the program and performance of the test article was excellent. This milestone provides strong confidence in the utility of the modification to be produced and installed, and to achieve the 30,000 flying hour requirement.

Budget Activity: Tactical Programs, #4
Program Element: 41119F, C-5 Squadrons

(U) During the second lifetime, specific requirements for crack propagation testing will be developed. An extensive inspection will be performed at the completion of the fatigue testing at 60,000 test hours to determine the state of the article. After the 60,000 hour inspection, the article may be used for further evaluation and crack propagation testing the extent of which will be dependent upon the article's condition.

(U) Because the wing modification design retained the general aerodynamic and subsystem configuration of the structurally deficient wing, an abbreviated flight test program was planned as explained in the next paragraph. Although completion of the Development Test and Evaluation portion of the flight test coincides with fabrication go-ahead for the first increment of production kits, C-5 force modification has been approved based on successful fatigue testing.

2. (U) Operational Test and Evaluation: Commencing in August 1980, C-5 Wing Modification Operational Test and Evaluation will be accomplished in three phases using one aircraft (680214): Combined Development Test and Evaluation/Operational Test and Evaluation called the Combined Phase, Phase I Follow-On Operational Test and Evaluation, and Phase II Follow-On Test and Evaluation.

(U) In the Combined Phase, Lockheed personnel conducted a month long test of the first operational aircraft modified with the new wing structural components at Dobbins Air Force Base, GA. The program consisted of nine flight test missions devoted to functional check flights of the aircraft systems, flutter, and active lift distribution control system reversion. Following these tests, the Air Force Flight Test Center initiated a series of performance and handling quality flight tests totaling six missions. The Air Force Test and Evaluation Center participated during the Combined Phase in conjunction with the contractor and the Flight Test Center. This phase of testing coincides closely with the production go-ahead. Parameters from the Combined Phase will be available to prepare an Air Force Test and Evaluation Center interim report by January 1981 for use by the Department of Defense.

(U) Preliminary results of the Combined Phase testing were excellent. The aircraft performed as expected logging 54.4 hours in 15 sorties with no wing modification discrepancies. The last flight was completed on 10 October 1980, two weeks ahead of schedule.

(U) The following operational test objectives have been identified for use in all phases of testing:

(U) Determine if modified aircraft's performance characteristics will permit planned mission accomplishment.

(U) Determine the response of the aircraft to pilot control inputs during normal and emergency operations of all planned mission segments, to include aerial refueling, crosswind landings, and no flap landings.

(U) Determine if operational crews can safely control the aircraft during all segments of planned missions under normal and emergency conditions while observing operational limits and recommended procedures.

(U) Determine the effect of interrupted or modified subsystems on maintainability, reliability, availability, logistics supportability, and operations and support cost elements.

Budget Activity: Tactical Programs, #4
Program Element: 41119F, C-5 Squadrons

(U) With the completion of the Combined Phase in October 1980, the aircraft will be deinstrumented, updated to reflect fatigue article findings and corrections, and delivered to the Air Force in December 1980. Follow-On Test and Evaluation Phase I, managed by Air Force Test and Evaluation Center, will begin in January 1981 at Dover Air Force Base, DE, a Military Airlift Command C-5A beddown location. Testing will be based on strategic airlift and training missions while employing a high flying hour usage and the "lead the force" concept. Phase I will last approximately four months and will focus on operational effectiveness and suitability. A final Air Force Test and Evaluation Center report will cover all Operational Test and Evaluation events completed during the Combined Phase and Phase I. The report will provide estimates of operational effectiveness and suitability, and identify system deficiencies. This phase of testing will be completed early enough for identified deficiencies to be corrected in the first production articles.

(U) Management responsibility of Phase II Follow-On Operational Test and Evaluation will belong to the Military Airlift Command. This phase is planned to start in May 1981 and continue until February 1982 when the first aircraft is delivered to the contractor for production modification. Military Airlift Command will continue to obtain data to increase the confidence of the effectiveness and suitability evaluation conducted during the earlier two phases while subjecting the test aircraft to the maximum exposure of their varied missions, worldwide route system and "lead the force" procedures. Throughout both Phase I and II, Loads Environment Spectra Survey data will be collected, reduced and analyze to assist in refining the Force Management Plan and aircraft availability estimates.

(U) Combined flight test crews representing the contractor, Air Force Flight Test Center, and Air Force Test and Evaluation Center accomplished inflight testing during the Combined Phase. Combined Military Airlift Command and Air Force Test and Evaluation Center flight crews will conduct Phase I and only Military Airlift Command aircrew personnel will complete Phase II. A small team of Military Airlift Command flight line maintenance and support personnel under Air Force Test and Evaluation Center management will conduct suitability evaluations in the Combined Phase and Phase I. Military Airlift Command flight line maintenance and support personnel will conduct a Phase II supportability evaluation.

3. (U) System Characteristics: The configuration of the modification includes new center, inner and outer wing boxes with internal structural changes. The exterior configuration remains essentially unchanged. The leading edge slats, ailerons, spoilers, trailing edge flaps, wing tips, and pylons from the old wing are to be reused.

(U) The following comparison details selected operational and technical characteristics of the C-5 aircraft: (1) operated in accordance with the C-5A flight manual limiting routine operation to 80% of the current wing structural limitations; (2) operations based on 100% of the current wing structural limitations for the C-5A; and (3) operations based on the estimated 100% structural limitations for the C-5 aircraft after Wing Modification. Range and payload capabilities will be demonstrated during the flight test program. The fatigue article testing will verify wing life characteristics. Internal wing subsystems will be evaluated to insure that reliability, availability and maintainability of these components are not reduced due to the modification using the latest data from the unmodified aircraft as the standard.

Budget Activity: Tactical Programs, #4
 Program Element: 41119F, C-5 Squadrons

CHARACTERISTICS	FLIGHT MANUAL	UNRESTRICTED C-5A*	WING MOD C-5	DEMONSTRATED
Cruise Speed (MACH)	.77	.77	.77	YES
Maximum Ramp Weight	732,500	769,000	840,000†	TBD
Maximum Takeoff Gross Weight (2.5G)	712,500	728,000	769,000	TBD
Maximum Takeoff Gross Weight (2.25G)†	728,000	764,500	794,000	TBD
Operating Weight Empty (Average)	354,000	354,000	372,500	YES
Maximum Payload (2.5G)	144,000	159,900	197,500	YES
Maximum Payload (2.25G)†	204,900	204,900	242,500	YES
Maximum Zero Fuel Weight (2.5G)	498,000	513,900	570,000	YES
Maximum Zero Fuel Weight (2.25G)†	558,900	558,900	615,000	YES
Fuel Capacity	318,100	318,100	332,500	YES
Wing Service Life (Hours)	7,100**	7,100**	30,000††	YES

* Exceeds 80% Structural Limitations (Non-Routine); † Wartime (restricted) Operation; ** Based on Representative Mission Profile Hours; actual peacetime flying time will average approximately 9800 flight hours; †† Post Wing Modification flying hours.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63735F Title: World Wide Military Command and Control System Architecture
 DoD Mission Area: Other Support Programs, #325 Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,250	6,900	9,200	10,100	Continuing	Not Applicable
2188	Air Force World Wide Military Command and Control System Systems Engineering Planning and Support	6,250	6,900	9,200	10,100	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force World Wide Military Command and Control System Architecture program is our mechanism for ensuring that more than 80 strategic command, control, and communication programs fit together as a cohesive whole. The program effort amounts to an overall system engineering job of identifying deficiencies and proposing alternative engineering solutions. This effort assures conformity of Air Force Command, Control, and Communications (C3) systems with the post 1985 WWMCCS Architecture. Specifically the job focuses on: (a) developing modifications to existing Air Force C3 systems - to enable continued operation with the World Wide Military Command and Control System as it is improved and (b) supporting implementation of Secretary of Defense programs that constitutes the post 1985 WWMCCS Architecture. The objective is to develop a total configuration which is balanced in terms of capability, survivability, and cost for serving the national needs and the mission of the Air Force. Tools employed include analysis, simulation and prototype development.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to continue system engineering and analysis efforts of Air Force strategic systems that contribute to the World Wide Military Command and Control System. Technical analysis and support will concentrate on Command, Control and Communication integration and survivability for warning information dissemination communications survivability and electromagnetic pulse hardening for Air Force strategic systems; improved crisis management support for the theater Commanders-in-Chief; and support to the World Wide Military Command and Control System Architect's initiatives. Cost estimate was formulated based on previous standard cost estimate for MITRE Corporation.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	7,100	10,000	8,329		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Project: #2188

Program Element: #63735F

DoD Mission Area: Other Support Program, #325

Title: Air Force WMMCCS Architecture

Title: World Wide Military Command and Control System Architecture
Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The World Wide Military Command and Control System provides the means for the operational direction and the administrative support involved in command and control of U.S. Military Forces. The primary mission is to support the National Command Authorities, with a secondary mission to support the command and control systems of the Services and subordinate commands. Essentially all Air Force strategic command, control and sensor warning systems are part of the World Wide Military Command and Control System. This program element serves two functions: intersystem engineering and architecture implementation. First, this program provides for an adequately integrated and standardized system of communications, command and control centers and sensors for the United States' strategic forces. The second effort of this program concerns the large number of improvements recommended in the World Wide Military Command and Control System Architecture concept and Selected Architecture programs, directed by the Deputy Secretary of Defense in 1976. System engineering and other technical analysis are required to support these activities which will impact Air Force systems. Such tasks as Jam-Resistant Secure Communications, Secure Voice and Graphics Conferencing, Joint Crisis Management Capability and World Wide Military Command and Control System Information System are a few that impact directly upon Air Force systems. Implementation of these tasks will require analysis of command, control and communications integration support from Air Force resources to effectively meet National as well as Air Force requirements. The Joint Crisis Management Capability initiative combines the funding of the Airborne Command Center and the Advanced Element of the Army's Rapid Reaction Deployable Command, Control and Communication programs. This activity includes command, control and communications integration, aircraft modifications and support to the Army as the cognizant component for accomplishing overall system integration activities. The deployable command, control and communications capability is designed to satisfy the needs of the theater Commanders-in-Chief for an improved crisis management capability. Some of the Jam-Resistant Secure Communications terminals will support the Joint Crisis Management Capability. Additionally Jam-Resistant Secure Communication terminals are programmed and are being acquired for support of the Sensor Warning Systems upgrade as well as other World Wide Military Command and Control Systems and Air Force World Wide Military Command and Control System elements. Air Force World Wide Military Command and Control Systems efforts in support of these two tasks will be directed at the interoperability requirement and interface definition for terminal installation at Air Force World Wide Military Command and Control System Element locations.

(U) RELATED ACTIVITIES: Air Force World Wide Military Command and Control System activities span the strategic command, control and communications community. System engineering and analysis are initiated in support of on-going product oriented programs within the Air Force. These efforts are needed to integrate the various product oriented programs/ systems into the World Wide Military Command and Control System Warning, Display and Command Systems. Analysis efforts will be conducted in support of missile tactical warning and attack assessment. Some specific program elements that relate to 63735F are Warning Information Correlation, Program Element 63429F, and Command Center Processing and Display System, Program Element 12431F. The Air Force World Wide Military Command and Control System provides for developing the overall architecture for all command and control functions, from sensor to user (end-to-end to include communications and survivability). Warning Information Correlation provides the research, development, test, and evaluation for improved missile tactical warning/ attack assessment including specific tactical warning/ attack assessment design for integration into the Command Center Processing and Display System. The Air Force World Wide Military Command and Control System in support of Command Center Processing and Display System proposes and assesses alternative technical approaches in system upgrades and participates on the User Executive System Management Group (a forum for obtaining

Project: #2188

Program Element: #63735F

DoD Mission Area: Other Support Programs, #325

Title: Air Force WMMCCS Architecture

Title: World Wide Military Command and Control System Architecture

Budget Activity: Intelligence and Communications, #5

community agreement on analyses efforts and recommendations). Command Center Processing and Display System responsibility begins at the communications processor and continues through display generation and display devices. Analysis efforts also will be conducted in support of the World Wide Military Command and Control System Architecture improvements monitored by the World Wide Military Command and Control Systems System Engineer and the selected architecture tasks managed by the Army, Navy and the Defense Communications Agency. All of these tasks require systems engineering and interface definition for implementation of their programs at Air Force installations. Specifically, the developmental effort for Joint Crisis Management Capability a selected architecture capability, is being accomplished under this PE; but the procurement for aircraft modification is supported by Program Element 4118F, (C-141).

(U) WORK PERFORMED BY: The Air Force World Wide Military Command and Control System Program Office, Electronics Systems Division, Hanscom Air Force Base, MA, conducts 90 percent of the work in-house with MITRE-Bedford technical support. A number of small systems engineering contracts, both competitive and sole source, have been used to fill gaps in expertise, time, or facilities. Through FY 1978, the following contracts at less than \$175,000 per fiscal year were let: Computer Multi-processor Simulation/Test, Honeywell, Phoenix, AZ; Modem Interoperability Analysis, Magnavox, Torrance, CA; Warning and Nuclear Detonation Communications Systems Analysis, TRW, Los Angeles, CA; Air Force World Wide Military Command and Control System Performance in an Electronic Warfare Environment, BDM, McLean, VA; Visually Coupled Displays as Executive Aids in Command Centers, Polhemus Navigation Science Corp., Essex Junction, VT; and Technical Support contract for support of improved Crisis Management Capability, Analytic System Engineering Corp., Burlington, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Completed system engineering and analysis efforts for: integration of command, control and communication systems into intercontinental ballistic missile launch control centers; automated data processing communications fault isolation procedures; HQ USAF Command, Control and Communications/Crisis Management within the Air Force Operations Center; COBRA DANE interface requirements documentation for program decisions and direction; PAVE PAWS interface requirements documentation; Joint Surveillance System/E-3A interface study; Minimum Essential Emergency Communications Network analysis (technical issues associated with survivable communications) and current operations concepts and plans; automated data processing communications error analysis; strategic/tactical command, control and communications intersystems engineering; comparisons of airborne command, control and communication systems and requirements such as Joint Airborne Communications Center/Command Post; Airborne Command and Control Center; crisis communications relay; FORWARD TALK Readiness Command replacement; and military satellite communications user subset architecture. Preliminary definition for the airborne command and control center was completed in this program element. Efforts to establish an outline for command, control and communications interface with the M-X missile and ground launched cruise missile programs began in FY 1978. However, future support provided to these programs will be funded by each specific Program Office. Also, the initial communication overlay input to the overall architecture for sensor warning system upgrade was completed in FY 1978. Assisted Ballistic Missile Office on M-X launch back-up communication from the World Wide Military Command and Control System. Accomplished preliminary design evaluation and checked-out the draft plan for Command Center

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Project: #2188

Program Element: #63735F

DoD Mission Area: Other Support Programs, #325

Title: Air Force WMMCCS Architecture

Title: World Wide Military Command and Control System Architecture

Budget Activity: Intelligence and Communications, #5

Processing and Display System end-to-end test. Participated in the Chairman/Joint Chiefs of Staff study of strategic command, control and communications connectivity. Performed preliminary costing and scheduling analysis for Joint Crisis Management Capability aircraft modification and supported the Army with development of Joint Crisis Management Capability system design. Participated in the development of a work plan for Jam-Resistant Secure Communication interface.

2. (U) FY 1981 Program: Intersystem efforts in FY 1981 will continue the development of an overall architecture for the tactical warning/attack assessment area. Specific focus will be on identifying deficiencies involving transfer of warning data in the compressed mode and sensor to user communications impact. Additional activities in support of the tactical warning/attack assessment area are to continue overall system engineering support and the development of an Intersystem Requirement Document. Command Center Processing and Display System support and coordination with space defense architecture will continue. Support of Military Air Command, Strategic Air Command, and Aerospace Defense Command's strategic command, control and communications improvement needs will be accomplished. Emphasis will be achieving timely pre-attack alerting and data handling; providing survivable and enduring command, control and communications capabilities for trans- and post-attack periods; facilitating reconstitution of command, control and communications assets during post-attack periods; and accomplishing support of improved crisis management capabilities for the theater Commanders-in-Chief. Implementation activity for selected architecture initiatives will focus on the Joint Crisis Management Capability and Jam-Resistant Secure Communications. Efforts for Joint Crisis Management Capability will be airborne command, control and communications and command, control and communications integration support, aircraft modification, and support of the Army as the cognizant component. Efforts for Jam-Resistant Secure Communications will be directed at the interoperability requirement and interface solution for terminal installation at Air Force World Wide Military Command and Control System element locations. Jam-Resistant Secure Communications will also support the Joint Crisis Management Capability and the survivable transfer of tactical warning/attack assessment information to the National Military Command Center and other command centers of the unified and specified commands. Additionally, support will be provided to the World Wide Military Command and Control Architect's initiatives (i.e., World Wide Military Command and Control System survivability Research and Development Plan).

3. (U) FY 1982 Planned Program: Efforts will center on: continuing analysis and system engineering for hardening Air Force command, control and communication systems against physical and electromagnetic threats; continuing the Joint Crisis Management Capability (accomplish aircraft modification (Research and Development work)); working on other World Wide Military Command and Control System selected architecture efforts (i.e., Secure Voice and Graphics Conferencing); preparing architectural documentation for a decision and direction on satellite system interface with the warning and assessment function of the World Wide Military Command and Control System; and providing program documentation and evaluation of World Wide Military Command and Control System Information System effort as it relates to modification of Air Force World Wide Military Command and Control System computer facilities. Budget increases in FY 1982 are a direct result of addressing an Office of the Secretary of Defense directed effort, the Joint Crisis Management Capability. This program supports an improved Crisis Management Capability for the theater Commanders-in-Chief. The increased funding will provide funding to accomplish the required research development testing and evaluation effort associated with accomplishing the aircraft modification.

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Project: #2188

Program Element: #63735F

DoD Mission Area: Other Support Programs, #325

Title: Air Force WWMCCS Architecture

Title: World Wide Military Command and Control System Architecture

Budget Activity: Intelligence and Communications, #5

4. (U) FY 1983 Planned Program: FY 1983 activities will include continuation of intersystem tasks (tactical warning, crisis management, and strategic forces command, control and communications) and the selected architecture tasks (Joint Crisis Management Capability, Jam-Resistant Secure Communications, Secure Voice Graphics Conferencing and others).
5. (U) Program to Completion: The Air Force World Wide Military Command and Control Systems Architecture is a continuing program. Most of the efforts will be in response to World Wide Military Command and Control Systems Architecture initiatives directed by the Office of the Secretary of Defense through the World Wide Military Command and Control System Systems Engineer. Programming for this period will not be by level-of-effort but by project.
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

Title: Navstar Global Positioning System

Budget Activity: Intelligence and Communications, #5

RESOURCES (PROJECT LISTING): (\$ in thousands)

PROJECT NUMBER	TITLE	FY 1980				FY 1981		FY 1982		FY 1983		Additional		Total Estimated Costs
		Actual		Estimate		Estimate	Estimate	Estimate	Estimate	Estimate	to Completion			
TOTAL FOR PROGRAM ELEMENT		138,007/		126,600				170,100		126,000		195,300	1,082,007	

1/ Reflects correction to amount reported incorrectly in Exhibit R-1 (15 Jan 1981) as 135,300 thousand.

(U) BRIEF DESCRIPTION OF PROGRAM ELEMENT AND MISSION NEED: This program element funds Air Force participation in the joint program for Phase II, full-scale engineering development, of the Navstar Global Positioning System. Program Element 64778F Navstar Global Positioning System reflects those funds previously reported (FY 1979 and prior) in Program Element 63421F Navstar Global Positioning System, Program Element 64478F Navstar Global Positioning System Space & Control Segments and Program Element 64778F Navstar Global Positioning System User Equipment. Military forces need to know precise location (1) to enhance command and control and to coordinate battle tactics and support; (2) to engage in strategic and tactical warfare; (3) to maneuver efficiently in the battle area; (4) to provide accurate and timely fire support; and (5) to facilitate combat support. A global, common grid positioning and navigation system is required to increase both the accuracy and the availability of current weapon systems, especially at night and in adverse weather, thus increasing their effectiveness. The Mission Element Need Statement was revalidated by the Secretary of Defense at Milestone II.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Continues full-scale engineering development of all three system segments (space, control and user equipment), the fabrication of three additional first generation satellites to replenish the five-satellite developmental constellation and the operation of the system to support both developmental testing of user equipment and the Navy's Fleet Ballistic Missile Improved Accuracy Program. The first replenishment satellite (Navstar 9) will be delivered and available for launch in FY 1982 with Navstars 10 and 11 delivered in FY 1983 to maintain the 4-to 5-satellite constellation into FY 1985 to support testing and special limited operations. Design changes to modify the developmental (first generation) Navstar satellite to meet operational requirements will be completed. These changes are required to launch the operational satellites on the Space Shuttle using a tailored upper stage (Payload Assist Module-Delta Class or PAM-D), to provide additional nuclear hardness, to incorporate the Integrated Operational Nuclear Detonation Detection System payload and to extend the expected lifetime. The initial (Phase I) control station at Vandenberg AFB, CA, will be modified to control the operational satellites during the Shuttle launch phase in 1985-1987 until the prime operational facility is available in 1987. During this upgrade, the initial control segment will continue to keep the developmental satellite constellation operational. Software/hardware design for the prime facility will continue. Hardware acquisition for the prime facility will begin. The dual-contractor competitive user equipment developmental effort will continue with equipment being delivered to enter developmental testing. Cost estimates are based on fixed price contracts covering full-scale engineering development of all three system segments.

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

Title: Navstar Global Positioning System (GPS)

Budget Activity: Intelligence and Communications, #5

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
RDT&E	142,200	126,800	123,200		215,000	933,200

(U) OTHER APPROPRIATION FUNDS:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
Procurement						
Program Element 35165F						
Missiles (Operational Satellites)			78,600	108,400	To Be Determined	
(Quantity)						
Program Element 35164F						
Aircraft (User Sets)					To Be Determined	
(Quantity)						
Other (Manpack User Sets)					To Be Determined	
(Quantity)						
Military Construction						
Program Element 35165F					14,700	14,700

(U) DETAILED BACKGROUND AND DESCRIPTION: Fundamental to the successful accomplishment of military functions is the ability to precisely position friendly forces relative to each other and with respect to enemy forces. Over the years, the Services have developed numerous positioning and navigation aids to satisfy specific requirements and to increase the effectiveness of weapon systems. Technologies available at the time these systems were developed tended to limit the design and application of these "pos/nav" aids to specific purposes with only a minimum of integration possible. Further improvement in the military utility of these systems has been constrained by accuracy limits, extent of geographic coverage, dependence on foreign basing rights and other reasons.

(U) Through extensive studies, analyses and tests, the Services confirmed that a single, highly precise, satellite-based positioning system could best satisfy the broad spectrum of the Department of Defense requirements documented in the Joint Chiefs of Staff Master Navigation Plan. Thus, in December, 1973, the need for the system was affirmed through the Defense Systems Acquisition Review Council Milestone I Review. Subsequently, the Defense Navigation Satellite System,

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

Title: Navstar Global Positioning System (GPS)
Budget Activity: Intelligence and Communications, #5

later named the Navstar Global Positioning System, entered the Concept Validation Phase (Phase I). The purpose of this phase was two-fold: (1) to validate that the technology was sufficiently mature to reasonably develop a system which could provide the required capability and (2) to demonstrate the military utility of this system.

(U) Four advanced development model Navstar satellites were launched in an eleven-month period in 1978 to provide the first satellite constellation. Forty-four advanced development model user sets were built and used in eleven different host vehicles in over 700 separate tests to satisfy Phase I objectives. A thorough system cost estimate was prepared to identify the total acquisition and 15-year operational costs. Force effectiveness studies were performed by all Services for a number of missions--all indicating positive benefits through extensive military use of the system. The only technical question remaining at the end of Phase I was the expected lifetime of the satellite-borne atomic frequency standards so a thorough development program was initiated to improve the atomic standard lifetime. Therefore, no major technical or operational issues caused undue concern at the Milestone II Review in June, 1979.

(U) Concern about system acquisition cost was the only qualifying comment in the Secretary of Defense's approval to proceed into Phase II, Full-scale Engineering Development Phase, on August 24, 1979.

(U) This concern over cost was subsequently manifested in a substantial reduction in approved program funding in the FY 1981 President's Budget relative to the funding required to implement the program as directed in August, 1979. On May 28, 1980, the Secretary of Defense approved a restructured program which matched the funding available. The major impacts of the restructured program were to delay deployment of the 18-satellite constellation from 1986 to late 1987 and to build to a constellation of 18 satellites instead of 24. However, the restructured program did provide a system which could readily accommodate future expansion to the full 24-satellite constellation. This change to 18 satellites slightly decreases system accuracy, but more importantly, reduces the resiliency and survivability of the system: individual satellite failures affect the accuracy and availability of navigation signals more severely with the 18-satellite constellation than with the 24-satellite constellation.

(U) In addition, the restructured program deferred incorporation of some capabilities until after deployment of the 18-satellite constellation. These deferred capabilities will not seriously impact the initial use of GPS but would adversely impact certain missions (operations in dense foliage, certain jamming scenarios and several naval missions) in the long term if totally omitted. As a result, the first generation satellite developed during Phase I will be minimally modified to increase the resistance of the satellite to nuclear effects, to add the capability to deny precision signals to adversaries and to launch the satellite from the Space Shuttle. The interim control segment to operate the system during the development phase consists of an interim control center at Vandenberg AFB, CA, four dispersed monitor stations and the Satellite Control Facility. This interim control center will be upgraded in FY 1982 to provide satellite control during launches of production spacecraft until the Operational Control Segment, including the Navstar Operations Center, is fully deployed and operational. Development of the Operational Control Segment is proceeding toward establishment of a prime facility with greater reliability than the interim control center and some increased automation to reduce the manpower/skill levels required. However, construction of the Navstar Operations Center facility was deferred until 1984. Development of the user equipment was not changed by the restructuring.

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

Title: Navstar Global Positioning System (GPS)

Budget Activity: Intelligence and Communications, #5

(U) The program as restructured will provide an unlimited number of users with a combination of accuracy, jamming resistance, survivability, coverage and force interoperability (through the common grid) far exceeding that of any other navigation system. With 18 satellites, suitably equipped United States/allied military users will be able to determine three-dimensional position (latitude/longitude/altitude) to an accuracy of 16 meters or better spherical error probable (50 percentile) and 40 meters or better on a 95 percentile basis.

(U) RELATED ACTIVITIES: The joint program manager coordinates the supporting activities of the Army, Navy, Marine Corps, Defense Mapping Agency, Department of Transportation and North Atlantic Treaty Organization through his deputies in the Joint Program Office. The use of the Global Positioning System for providing guidance corrections for tactical missiles is being separately explored under Program Element 63601F, Conventional Weapons Technology. Investigation of advanced anti-jamming technology is being conducted under Program Element 63203F, Advanced Avionics for Aircraft. Program Element 64778F also supports the Navy's Fleet Ballistic Missile Improved Accuracy Program (Program Element 11221N Fleet Ballistic Missile Systems) and the Minuteman guidance testing under Program Element 11213F, Minuteman Squadrons. The North Atlantic Treaty Organization Global Positioning System Project, a cooperative venture between the United States and nine other nations, provides information to these nations to assist in making decisions about adopting the system for military forces.

(U) Full-scale engineering development of user equipment is funded by all services under Program Element 64778A/N/F Navstar Global Positioning System for the Army, Navy, and Air Force, respectively. Acquisition is reflected in Program Element 35164A/N/F, all titled Navstar Global Positioning System User Equipment, and Program Element 35165F Navstar Global Positioning System Space & Control Segments.

(U) An Integrated Operational Nuclear Detonation Detection System payload will be flown with the refurbished qualification vehicle (Navstar 7) of the first generation satellites, on all replenishment development satellites (Navstars 9-11) and on all subsequent Navstar operational satellites. Program Element 31357F, Integrated Operational Nuclear Detonation Detection System, funds these payloads. Integrated acceptance testing has insured compatibility of the nuclear detonation detection and navigation payloads on Navstar 7. A more powerful second stage launch capability was acquired to provide the additional throw-weight capability required by the addition of the nuclear detonation detection payload. Expendable launch services (Atlas E/F) are funded under Program Element 35119F, Space Boosters. Space Shuttle launches are funded under Program Element 35171F, Space Launch Support.

(U) WORK PERFORMED BY: The Joint Program Office is located at the Air Force Systems Command's Space Division, El Segundo, CA. The satellite contractor is Rockwell International/Space Operations and Satellite Systems Division, Seal Beach, CA; International Telephone and Telegraph, Nutley, NJ, is the subcontractor for the navigation subsystem. Aerospace Corp., El Segundo, CA, provides technical and engineering support. User equipment development is being performed competitively by Magnavox Advanced Products Div., Torrance, CA, and Rockwell International/Collins Government Avionics Div., Cedar Rapids, IA; Intermetrics, Cambridge, MA, is the independent user equipment software verification/validation contractor. Operational Control Segment development/deployment is being done by International Business Machines/Federal Systems Div., Gaithersburg, MD; Logicon, Long Beach, CA, is the independent software verification/validation contractor.

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

Title: Navstar Global Positioning System (GPS)

Budget Activity: Intelligence and Communications, #5

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1980 and Prior Accomplishments: The first four navigation development satellites (Navstars 1-4) were launched during 1978 to form the 4-satellite test constellation used to provide data for the Defense Systems Acquisition Review Council Milestone II. User equipment has been tested on the C-141, UH-1H, F-4J and P-3 aircraft, wheeled and tracked vehicles, ships and manpacks. Actual testing has verified that positioning accuracy is within the ten meters predicted for a 24-satellite system. Development testing to demonstrate the effects of improved positioning accuracy on bomb delivery yielded significant results. Inert 500-pound bombs (MK-82) dropped from two Navy F-4J aircraft with several different crews have impacted the target area with an order of magnitude improvement in accuracy over current methods. Both straight-and-level and toss delivery modes have been used. Improved weapon delivery accuracy with different crews and aircraft in over 500 separate bomb deliveries has verified that the Global Positioning System itself is the prime source of improvement. Other demonstrations of the military value of precise positioning have included passive rendezvous similar to aerial refueling, simulated precision helicopter rescues, aircraft reconnaissance of a preselected ground point, simulated combined aircraft/ship antisubmarine operations and reduced visibility ship departures from harbor.

(U) Following the Milestone II approval, the competitive full-scale engineering development program for user equipment was begun. Additional developmental satellites (Navstars 9-12) were ordered for 1982/1983 deliveries to replenish the satellite constellation. These additional satellites are necessary to reasonably insure the existence of at least a 4-satellite constellation for user equipment testing in 1983. Modification of the initial satellite design to add required operational capabilities, including tailoring for Shuttle launches, was delayed until early FY 1981 because of the program restructuring. As part of the restructuring, Navstar 12 was designated as the modification/block change qualification vehicle; therefore, that vehicle will not be launched as a replenishment satellite.

(U) North Atlantic Treaty Organization Project activities have included the successful demonstration of manpack positioning (accuracies within 10 meters) in eight European nations and Canada. The Project has begun developing standards for the development/production of user equipment to further rationalization, standardization and interoperability objectives.

2. (U) FY 1981 Program: The development satellite constellation will be maintained to support the Navy's Improved Accuracy Program and continued Global Positioning System user equipment testing. Navstar 7 satellite will be launched to replace Navstar 1 which has experienced malfunctions in the atomic frequency standards. These problems were analyzed and corrected in Navstar 3 and subsequent satellites. Orbital operations with the modified atomic frequency standards has been excellent since Navstar 3 was launched in October 1978. Fabrication of the three replenishment satellites (Navstars 9-11) for delivery in 1982-1983 will continue. Satellite design modifications to incorporate operational requirements began early in the fiscal year. The development and integration of mission control functions for the control segment will continue with the software preliminary design review. User equipment development will continue with both contractors holding critical design reviews of the user sets and their interfaces with the test platforms.

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

Title: Navstar Global Positioning System (GPS)

Budget Activity: Intelligence and Communications, #5

3. (U) FY 1982 Planned Program: Replenishment satellite Navstar 9 will be tested and delivered ready for launch. Fabrication of Navstars 10 and 11 will continue toward a 1983 delivery. Development of the prototype operational spacecraft will continue with the critical design review, production readiness review and fabrication start. Control segment development will continue with the software critical design review. Hardware acquisition for the prime operational facility will begin. A new computer will be installed in the interim control center at Vandenberg Air Force Base to maintain system accuracy and to reduce maintenance. User equipment development will continue with integration of pre-production user equipment into Phase II host vehicles and start of development test and evaluation.
4. (U) FY 1983 Planned Program: The last two replenishment satellites will be delivered for launch. Fabrication of the prototype operational satellite will be followed by qualification testing. Test of the two families of user equipment will continue with initial operational test and evaluation starting on aircraft, land vehicles, ships and manpacks. Control segment development will continue with delivery of the first operational monitor station.
5. (U) Program to Completion: The Vandenberg Air Force Base interim control center will support the first operational satellite launch with the shuttle in FY 1985. Operational control segment development will culminate with combined development test and evaluation/initial operational test and evaluation beginning in CY 1985 and the segment becoming operational in CY 1987. Integration engineering for all remaining Air Force aircraft (other than the F-16 and B-52D which are the initial test vehicles) will be accomplished. Qualification testing of the modified satellite will be completed before the first Shuttle launch of a production satellite.
6. (U) Milestones
- | | <u>Previous Date*</u> | <u>Current Date</u> |
|---|-----------------------|---------------------|
| a. Defense Systems Acquisition Review Council Milestone II | | Jun 1979 |
| b. Launch Satellite Navstar 5 (replaced Navstar 2) | | Feb 1980 |
| c. Launch Satellite Navstar 6 (to achieve 5-satellite constellation) | | Apr 1980 |
| d. Launch Satellite Navstar 7 (replaces Navstar 1) | (Oct 1980)** | Apr 1981 |
| e. Launch Replenishment Satellite Navstar 8 (as required) | | (3Q CY 1981)** |
| f. Launch Replenishment Satellite Navstar 9 (as required) | | (3Q CY 1982)** |
| g. Begin Initial Operational Test and Evaluation | 4Q CY 1982 | 1Q CY 1983 |
| h. Complete Initial Operational Test and Evaluation | | 3Q CY 1983 |
| i. Defense Systems Acquisition Review Council Milestone III | | 3Q CY 1983 |
| j. First Shuttle Launch | 4Q CY 1984 | 1Q CY 1985 |
| k. Worldwide Three-dimensional Operational Capability (18 satellites) | | 4Q CY 1987 |

* Dates presented in FY 1981 Descriptive Summary are shown if changed in FY 1982 Descriptive Summary.

** Replenishment launches shown in parentheses indicate probable launch dates.

(U) Explanation of Milestone Changes: Navstar 7 launch was delayed to replace components which failed during test. The other schedule changes resulted from program delays caused by the program restructuring early in 1980.

Program Element: #64778F

DOD Mission Area: Navigation and Position Fixing, #321

7. (U) Resources: Not Applicable

Title: Navstar Positioning System (CPS)

Budget Activity: Intelligence and Communications, #5

8. (U) Comparison with FY 1981 Budget Data: (\$ in thousands)

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Cost</u>
FY 1982 Descriptive Summary	138,007	126,600	170,100	126,000	195,300	1,082,000
FY 1981 Restructured Program	142,200	126,800	123,200	87,900	127,100	933,200
Difference	- 4,193	- 200	46,900	38,100	68,200	148,800

FY 1980 funds in the amount of 4.2 million dollars from Program Element 64778F were excess to FY 1980 needs because of delay in beginning development efforts caused by the program restructuring. The changes in the estimates for FY 1981 to completion result from Secretary of Defense directed reinstatement of some of the system capabilities deferred in the program restructuring and the decision to acquire operational control segment hardware with RDT&E funds. This decision transferred 41.9 million dollars from Program Element 35165F (FY 1982, Other Procurement) to Program Element 64778F (adds of 25.3, 10.3, 4.2 and 2.1 million dollars in FY 1982-FY 1985 respectively).

Budget Activity: Intelligence and Communications, #5

Program Element: #64778F, Navstar Global Positioning System

Test and Evaluation Data

1. Development Test and Evaluation: This Program Element covers the development of the Navstar Global Positioning System. Phase I testing validated the system concept, identified preferred design parameters and demonstrated military utility. In the space segment, six of the eight development satellites procured for the Validation Phase (Phase I) have been launched, checked out and declared operational to support the testing of the user equipment. Several failures in the satellite borne rubidium atomic time standards (clocks) used to provide the stable frequency source required for precise Global Positioning System performance have occurred on the first two satellites launched (Navstars 1 and 2). Because of these failures, significant effort since 1978 has been placed on improving clock reliability. Clock electronics design changes have been incorporated on the third and subsequent satellites. Material and process changes in manufacturing the rubidium clock lamps have been made and improved lamps fabricated. Navstars 5 and 6 (launched in February and April 1980) are the first to have the improved lamps. The clock performance on these two satellites meets system performance requirements. Continued within-tolerance clock performance will demonstrate that the design clock reliability has been achieved. Currently five of six satellites are supporting user equipment testing. Navstars 1 and 2 exhibit frequency stability worse than the specification requires, but Navstar 1 is adequate for test operations if additional synchronized time messages are uploaded from the control station during tests. Navstar 2 frequency stability is not adequate for testing. Navstar 3-6 all exhibit required frequency stability. One of the two remaining Phase I satellites (Navstar 7) will be launched in April 1981 to provide additional test instrumentation for the Navy's Fleet Ballistic Missile Improved Accuracy Program. It will carry an Integrated Operational Nuclear Detonation Detection System secondary payload. User equipment testing with the Global Positioning System providing 3-dimensional position and velocity data (four satellite coverage) began in January 1979. Testing with all platforms (C-141, P-3B, F-4J, UH-1H and Army truck) prior to the Defense System Acquisition Review Council Milestone II in June 1979 demonstrated navigation and positioning accuracies within ten meters 50% of the time. On a F-4J aircraft, the multichannel Global Positioning System receiver developed by Magnavox integrated with an inertial measurement unit has achieved positioning accuracies which have permitted straight and level and toss bombing demonstrations with of the bombs landing within of the target. These results were obtained from over 500 separate bomb releases from various altitudes below 10,000 feet. The program's F-4J reached the end of its service life and was retired to the "bone yard" in early 1980. Another F-4J has now been modified and is dropping bombs with accuracies similar to those of the first one. The performance of the second F-4J shows that the Global Positioning System precision is really in the system and not any one aircraft. User equipment testing and demonstrations with Phase I sets have been done under a ten nation North Atlantic Treaty Organization Memorandum of Understanding as well as the Development Test and Evaluation effort. Manpacks have been demonstrated at ten European/Canadian locations. Positioning performance in all cases met system requirements. A "low cost" set navigated successfully over the North Pole in a United Kingdom aircraft. Development Test and Evaluation of the space and ground control segments will be limited to refining further the effects of seasonal variations on satellite ephemeris predictions and determining the long-term reliability of the space segment.

Although not done as part of the development test and evaluation program, Global Positioning System instrumentation packages have been successfully flown on two Minuteman III launches (January and March 1980). Global Positioning System estimates of missile three dimensional position and velocity met all requirements.

2. (U) Operational Test and Evaluation: Phase I testing demonstrated coordinated bombing, passive rendezvous, special anti-jam performance, approach to landing, Army land operations, and coordinated sea operations. The Air Force Test and Evaluation Center monitored selected portions of user equipment testing and provided an independent assessment for the Milestone II program review. No operational deficiencies were noted.

(U) In the Full-Scale Engineering Development Phase (Phase II) of the program, the Air Force Test and Evaluation Center will be the executive test agency for all Global Positioning System operational test and evaluation. Multi-service operational test and evaluation will be conducted on user equipment and the control segment, while the space segment testing will be primarily an Air Force effort.

(U) The user equipment operational test and evaluation is scheduled from mid-December 1982 through early July 1983. The Army, Navy, Air Force, Marine Corps, Defense Mapping Agency, and North Atlantic Treaty Organization will participate in the operational testing of the user equipment in a broad range of military applications. User equipment testing will include several months of combined development test and evaluation/operational test and evaluation and six months of separate operational test and evaluation prior to the Defense Systems Acquisition Review Council Milestone III review. This testing is intended to provide the independent operational test and evaluation input for a user equipment production decision in September 1983. Primary test vehicles will be: B-52D (with Digital Bombing Navigation System), F-16, P-3C, and A-6 aircraft, aircraft carrier, attack submarine, Army tank, UH-60 helicopter, and a manpack. Operator and maintenance personnel will be drawn from operational units. Primary test locations will be Yuma Proving Ground, AZ; Nellis Air Force Base, NV; Eglin Air Force Base, FL; Fort Carson, CO; and the San Clemente Island Test Area, CA. Phase II user equipment contractors are Magnavox and Rockwell International/Collins Government Avionics Division.

(U) Control segment testing will begin in April 1985 and extend to approximately January 1987. A period of combined development test and evaluation/initial operational test and evaluation followed by a dedicated 90-day initial operational test and evaluation is planned. Qualified satellite command and control operators and maintainers from the Strategic Air Command, the system operating command, will perform the 90-day initial operational test and evaluation.

(U) Space segment testing will consist primarily of combined development test and evaluation/initial operational test and evaluation and is divided into two phases. Phase A will address the current operational constellation. The report from Phase A will support a production go ahead scheduled for December 1981. The Phase B report, which will address the operational satellites, is projected for the middle of 1985, following the shuttle launch of the first operational satellites (first quarter CY 1985). Specific areas to be addressed in space segment operational test and evaluation include survivability, operability, and the effects of satellite outages on system accuracies. Sole space segment contractor is Rockwell International/Space Operations and Satellite Systems

(U) The Navstar Global Positioning System Operational Test and Evaluation Program has several objectives:

- a. (U) To evaluate Global Positioning System performance in a spectrum of missions in representative vehicles for Army, Navy, Air Force, Marine Corps, and Defense Mapping Agency application. These include air, land, and water navigation, ordnance delivery, rendezvous, and landing approaches in both passive and hostile environments.
- b. (U) To evaluate Global Positioning System performance when operated and maintained by Air Force, Army, Navy, and Marine Corps operational and maintenance personnel.
- c. (U) To identify and track deficiencies and improvements.

3. (U) System Characteristics:

<u>Characteristic</u>	<u>Objective</u>	<u>Demonstrated</u>
Three-dimensional Position Accuracy	16 meters (50% of time)	11.1 meters (Note 1)
Three-dimensional Velocity Accuracy	0.1 meters/second	0.12 meters/second
Time Transfer	10x10 ⁻⁹ second	25 x 10 ⁻⁹ second (Note 2)
Satellites on Orbit	18 (Note 3)	6
Satellite Coverage	24 hours/day world-wide	4 hours/day over test area
Clock Stability	2x10 ⁻¹³	2x10 ⁻¹³
Satellite Mean Mission Duration	6 years	3 years (not valid for projections) (Note 4)

NOTES:

1. (U) Accuracy is within 11.1 meters 50% of the time and 22 meters 90% of the time with test constellation spacing the same as a 24-satellite constellation. The 16 meter objective (18 satellites) corresponds to 10 meters (24 satellites).
2. (U) The standard deviation of the synchronization error is 25 nanoseconds.
3. (U) The program restructure approved by the Secretary of Defense on May 28, 1980, reduced the constellation size from 24 to 18.
4. (U) Phase I prototype spacecraft have a design mean mission duration of 4.6 years. The prototype spacecraft in orbit are supporting testing in spite of several clock failures. Fixes implemented on Navstars 3-6 and planned for/already installed on the two remaining prototype spacecraft are expected to permit achieving the 4.6 year mean mission duration.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65708P Title: Aircraft Navigation System Verification
 DoD Mission Area: Navigation and Position Fixing, # 321
 Budget Activity: Intelligence & Communications, #5

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

PROJECT NUMBER	TITLE	FY 1980				FY 1981				FY 1982				FY 1983				FY 1984				Total			
		Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
	TOTAL FOR PROGRAM ELEMENT	1,300				1,580				1,700				1,900				Continuing				Not Applicable			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides for the standardized test and evaluation of inertial and inertially aided aircraft navigation systems at the Central Inertial Guidance Test Facility (CIGTF). This testing determines the navigational performance and operability of inertial and inertially aided aircraft navigation systems prior to their consideration for use by Department of Defense agencies. The CIGTF evaluation prevents acquisition of high risk systems through quantitative test and evaluation. This Program Element provides standard, unbiased system evaluation under conditions closely simulating the operational environment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Standardized tests of inertial and other DoD navigation systems in cargo, helicopter and fighter testbed aircraft will be performed based on intended application. Verification of the Rockwell high accuracy inertial navigation system and the Honeywell Ring Laser Gyro Navigation System will be completed. Two additional systems will begin verification testing as identified through the FY 1981 "call to industry." Both of these systems are expected to be ring laser gyro systems and direct competitors with the Honeywell system which is currently undergoing verification. The data from these tests will provide the Department of Defense a common baseline to evaluate the performance of ring laser gyro technology. The situation will be similar to what was available in the 1970s for the spinning mass inertial gyro technology. Work will also continue through NATO and international technical committees to develop a free world standard test requirement which will provide a standard unbiased method of evaluating inertial navigation systems throughout the free world. The Completely Integrated Reference Instrumentation System developed under this program element will continue to be used as the primary reference system for the B-52 Offensive Avionics Systems development and test program.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980				FY 1981				FY 1982				FY 1983				FY 1984				Total			
	Actual	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate	Estimate
	1,300				1,580				1,700				1,900				Continuing				Not Applicable			

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #65708F

DoD Mission Area: Navigation and Position Fixing,
321

Title: Aircraft Navigation System Verification
Budget Activity: Intelligence & Communications,
#5

(U) DETAILED BACKGROUND AND DESCRIPTION: This program implements Department of Defense DoD direction to test new aircraft inertial and inertially aided navigation systems at the Central Inertial Guidance Test Facility (CIGTF) and to use the results of the testing as a basis for system selection for the DoD use. Government and non-government agencies may request that flight evaluation be performed on a candidate system. The CIGTF was created in 1959 to give the Air Force a quantitative evaluation capability for testing intercontinental missile guidance systems. The facility was expanded in the mid-1960s to include aircraft inertial navigation systems. The development of the Completely Integrated Reference System (CIRIS) allowed CIGTF to expand its capability to test a full spectrum of navigation and guidance equipment. The centralized test facility avoids costs of duplicate service test centers. Standardization of tests provides common yardsticks for comparative evaluations. A common core of personnel and equipment is maintained to insure meaningful evaluation of systems tested.

(U) RELATED ACTIVITIES: This program element documents actual performance of inertial guidance systems which have potential application to Air Force, Navy, and Army weapon systems. This program interfaces with Program Element 65807F, Test and Evaluation Support. The test facility is also available to National Aeronautical and Space Agency, Federal Aviation Administration,, and private industry through government sponsorship on a reimbursement basis.

(U) WORKED PERFORMED BY: This program element is managed by the Central Inertial Guidance Test Facility, Air Force Armament Development and Test Center, Holloman AFB, NM, an organization of the Air Force Systems Command. Representative contractors that have been involved are Litton Systems, Incorporated, Woodland Hills, CA; Teledyne Systems, Incorporated, San Diego, CA; Singer-Kearfott, Incorporated, Little Falls, NJ; Delco Electronics, Santa Barbara, CA; Hamilton Standard, Windsor Locks, CT; Honeywell Aerospace, Clearwater, FL; Rockwell International, Anaheim, CA.

Program Element: #65708F

DoD Mission Area: Navigation and Position Fixing,

321

Title: Aircraft Navigation System Verification

Budget Activity: Intelligence & Communications,

#5

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: More than twenty navigation systems have completed verification tests. These include the Singer 2400 and the Carousel IV selected for the F-16 and the C-141 navigation modernization respectively. The Standard Precision Navigator completed verification testing in 1976. Standard Inertial Navigation System screening tests were successfully completed on three systems during 1978. Qualification testing on the three Standard Inertial Navigation Systems was completed in FY 1980. Work was begun in FY 1980 on the verification of the Delco Carousel IVE High Accuracy Navigation System and on engineering tests of the Honeywell Ring Laser Gyro Navigator. The Delco testing will complete in early FY 1981. The Honeywell ring laser gyro engineering tests will convert to verification testing in FY 1981. The evaluation of the Marine TPQ-27, Radar Bomb Scoring System was completed using the Automatic Reference Instrumentation System (ARIS). The use of the ARIS in the TPQ-27 tests resulted in more accurate ballistic tables being developed than had been possible with previous instrumentation systems. Verification tests of three prototype and two preproduction nuclear hardened doppler velocity sensors in support of the Common Strategic Doppler Program were completed in 1978. Two Completely Integrated Reference Instrumentation System palletized equipment stations for cargo testbed and two pod versions were fabricated. One pod version to provide the prime reference for a fighter testbed and the second to provide the reference in support of the Strategic Offensive Avionics Program. The Completely Integrated Reference Instrumentation System frequency conversion to comply with National Range requirements has been completed.
2. (U) FY 1981 Program: Verification testing on the Delco High Accuracy Navigation System and the Honeywell Ring Laser Navigation System will complete. Verification testing of the Rockwell and Singer High Accuracy Navigation Systems will begin. Completely Integrated Reference Instrumentation System/Automatic Reference Instrumentation System development will be completed with the addition of new recorders and Global Positioning System interface equipment. With the completion of the Honeywell Ring Laser Gyro Navigation System tests the Department of Defense will have the first common standardized test results with which to evaluate this new technology to determine how it performs in comparison to the spinning mass technology currently in use. Flight testing of the B-52 Offensive Avionics System using the Completely Integrated Reference Instrumentation System instrumentation will continue.
3. (U) FY 1982 Planned Program: Two additional Ring Laser Gyro Inertial Navigation Systems will undergo verification testing. The expected candidates are built by Litton and Singer. When these two systems complete testing the Department of Defense will have available for procurement purposes unbiased standard performance data on ring laser gyro systems built by three of the five leading companies in the ring laser gyro navigation industry. With this data base the DOD will be able to determine the capability of the technology to meet military navigation requirements before committing to it for a major new weapons system or update. The use of the Completely Integrated Reference Instrumentation System in the B-52 Offensive Avionics Program will complete. The increase in the FY 1982 funding is due to a change in the escalation index.

Program Element: #65708F

DoD Mission Area: Navigation and Position Fixing,
321

Title: Aircraft Navigation System Verification

Budget Activity: Intelligence & Communications,
#5

4. (U) FY 1983 Planned Program: Verification and developmental testing will continue with the evaluation of approximately three navigation systems.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #31324F (31027F)

Title: FOREST GREEN

DOD Mission Area: General Defense Intelligence Programs, #312

Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
1	TOTAL FOR PROGRAM ELEMENT	3,200	15,741*	21,200*	29,168*	Continuing	Not Applicable

* Program Element 31324F was previously Program Element 31027F

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The principle objective of the RDT&E program is to correct deficiencies in the

The RDT&E effort is directed at the development of new scientific sensors, collection devices and analytical techniques to satisfy specific

BASIS FOR FY 1982 RDT&E REQUEST: This program will support continuing development efforts to improve and modernize the collection, analytical, and evaluation systems and to reduce operating costs while improving performance.

Program Element: #31324F (31027F)

DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN

Budget Activity: Intelligence and
Communications, #5

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional to</u>	<u>Total Estimated</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Completion</u>	<u>Costs</u>
RD&E	3,200	27,875	24,465		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

Procurement						
Missile *	2,600	1,420	2,130	3,671	Continuing	Not Applicable
Other **	3,614	353	10,904	10,292	Continuing	Not Applicable
Operation & Maintenance ***	10,220	10,756	8,788	10,043	Continuing	Not Applicable
* Missile Procurement is for						
						sensor procurement and integration
** Other procurement include peripherals/software for the headquarters						
*** O&M funds include follow-on support for the interim electromagnetic pulse technique, operational test and evaluation of newly developed systems and equipment, and station operations.						

Program Element: #31324F (31027F)

DOD Mission Area: General Defense Intelligence Program, #312

Title: FOREST GREEN

Budget Activity: Intelligence and
Communications, #5

DETAILED BACKGROUND AND DESCRIPTION: This is a continuing program to improve the

Program Element: #31324F (31027F)

DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN

Budget Activity: Intelligence and
Communications, #5

RELATED ACTIVITIES:

WORK PERFORMED BY:

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

Program Element: #31324F (31027F)

DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN

Budget Activity: Intelligence and
Communications, #5

Program Element: #31324P (31027P)
DCD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN
Budget Activity: Intelligence and

Program Element: #31324F (31027F)

DOD Mission Area: General Defense Intelligence, #312

Title: FOREST GREEN

Budget Activity: Intelligence and
Communications, #5

2. (S) FY 1981 Program: An extensive RDT&E program to continue to improve the capabilities of

3. (S) FY 1982 Planned Program:

Program Element: #31324F (31027F)
DOD Mission Area: General Defense Intelligence Programs, #312

Title: FOREST GREEN
Budget Activity: Intelligence and Communications, #5

4. FY 1983 Planned Program: Major efforts initiated in FY 1981 and FY 1982 will be continued in FY 1983.

5. (U) PROGRAM TO COMPLETION : This is a continuing program.

6. Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #31357F/12433F

Title: Integrated Operational NUDETS
Detection System (IONDS)

DoD Mission Area: General Defense Intelligence Programs, # 312
Strategic Surveillance and Warning, #132

Budget Activity: Intelligence and
Communications, #5
Strategic Programs, #3

(U)Resources (Project Listing): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
31357F		11,900*	11,953	4,500	2,047	Continuing	Not Applicable
12433F		0	4,000	7,000	TBD	Continuing	Not Applicable

*PE 63435F

BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Development of an Integrated Operational Nuclear Detonation Detection System (IONDS) is being pursued in this element. The IONDS is being developed to provide a capability to detect, locate, and report in near real time tactical nuclear detonations on a global basis. IONDS will provide data to satisfy for sensors on and NAVSTAR Global Positioning System (GPS) satellites and ground readout and display equipment for several users: the National Command Authorities, commanders of theaters and unified/specified commands, Air Force Technical Applications Center, and others as may be designated.

(U)BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 program will support procurement of IONDS L3 down-link hardware, integration of IONDS components on GPS satellites #9 through #12, completion of development of the data cross-link, and initial development of the ground/airborne user terminal.

(U)COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: The FY 81 program was included in the Descriptive Summary for PE 31027F. Additional funding in FY 1982 supports development of the IONDS satellite-to-satellite data cross-link and development of the user terminal.

(U)OTHER APPROPRIATION FUNDS:

Missile Procurement (PE 31357F)	16,435	22,526	Continuing	Not Applicable
Other Procurement (PE 12433F)		11,300	Continuing	Not Applicable

Program Element: #31357F/12433F

Title: Integrated Operational NUDETS
Detection System (IONDS)

DoD Mission Area: General Defense Intelligence Programs, #312
Strategic Surveillance and Warning, #132

Budget Activity: Intelligence and
Communications, #5
Strategic Programs, #3

DETAILED BACKGROUND AND DESCRIPTION: The U.S. nuclear detonations (NUDETS) reporting system is comprised of sensors and reporting elements which were developed primarily for technical intelligence reporting. The effectiveness of these systems in reporting NUDET events during limited or general war will degrade rapidly during the opening phases of an attack. The objective of this program is to remove deficiencies resulting from Soviet technological advances and limitations inherent in current U.S. surveillance systems. A study was performed in FY 1975 by Air Force Systems Command, with Strategic Air Command, Aerospace Defense Command, and Air Force Technical Applications Center (AFTAC) participation, to evaluate current systems and determine sensor capabilities required to provide the National Command Authorities (NCA) information on which to base the selection of appropriate trans attack responses and to support effective strategic force management during all phases of a nuclear conflict. The study concluded that a highly survivable nuclear detonation system is required to enhance the ability of the NCA and theater commanders to assess the nature of attacks on the Continental United States and on our overseas forces. A space based nuclear detonation detection and diagnostic system exists today. This system consists of radiation detection sensors on satellites, bhangmeters on other program satellites, and ground elements of the and the

Satellite Control Facility. Bhangmeters will be deployed on satellites as replacement satellites and the are required. Of the current systems, the NUDET detection and location data to the NCA, designated Commanders-in-Chief, and other users.

Current space assets will be combined with additional resources, where practical, to satisfy NCA and theater NUDET surveillance requirements, while continuing to fulfill the requirements for

The IONDS system, as planned, will consist of improved sensors on and sensors on Global Positioning System (GPS) satellites with ground readout and processing equipment for the system users. In FY 1976 and FY79 a contracted effort, by Ford Aerospace and Electronics Co., evaluated parametrically how best to accomplish the IONDS requirements and then produced a system design definition. Concurrently, a contract with Rockwell International defined the GPS interface modification requirements to support IONDS. Rockwell International completed the contract to identify specific interface and subsystem designs for IONDS and performed testing to validate that there would be no mission impact on GPS satellites incorporating IONDS subsystems.

RELATED ACTIVITIES: Development of the IONDS was previously pursued under Program Element (P.E.) 12433F in FY 1978 and P.E. 63435F in FY 1979 and FY 1980. NUDET sensors are currently deployed on improved sensors will be deployed on those satellites as IONDS becomes operational. As an interim step in achieving the IONDS full operational capability, sensors were deployed on satellites of the starting with the satellite launch IONDS sensors are planned for deployment on GPS (P.E. 64778F) as early as the launch of the refurbished Qualification Test Vehicle in early FY 1981. Development and production of the NUDET sensors for IONDS/GPS is being funded by the Department of Energy, with support from

1044

Program Element: #31357F/12433F

Title: Integrated Operational NUDETS
Detection System (IONDS)

DoD Mission Area: General Defense Intelligence Programs, #312
Strategic Surveillance and Warning, #132

Budget Activity: Intelligence and
Communications, #5
Strategic Programs, #3

(U)WORK PERFORMED BY: Development and procurement is accomplished by Hq Space Division, Los Angeles, Ca with the assistance of the Air Force Technical Applications Center, Patrick AFB, Fl. Rockwell International, Downey, Ca completed preliminary Global Positioning System/IONDS interface studies during FY 1976 and is currently under contract to develop and test interface and subsystem designs for IONDS. Ford Aerospace and Electronics Co., Palo Alto, Ca performed System Definition Studies in FY 1976 and FY7Q and is continuing to provide systems engineering support. Sandia Corporation, Albuquerque, NM will develop and produce the nuclear detonations sensors.

(U)PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U)FY 1980 and Prior Accomplishments: In response to an evolving requirement for an increased NUDET detection capability, an IONDS/NAVSTAR GPS study was performed by the NAVSTAR GPS payload contractor under Project 2124 of P.E. 63424F in FY 1975. Although this study concluded that a relatively simple sensor package could be accommodated within the weight, power, and physical constraints of the predicted GPS Phase II satellites, subsequent analysis of the GPS requirements have altered some of these conclusions. In FY 1976 Ford Aerospace and Electronics Co. conducted a contracted study to parametrically explore feasible alternatives to performing the IONDS task. This study also sized the system and produced a preliminary design definition. Also in FY 1976, Rockwell International conducted a study to further define the IONDS/GPS interface requirements. In FY7Q a study was performed to define performance and costs for a change to the GPS launch vehicle if one is required because of increased weight from the incorporation of secondary payloads on the GPS Phase II satellites. Contract work with Rockwell continued in FY 1977 to modify the GPS Development Test Vehicle to include the IONDS payloads and perform integrated functional and electromagnetic compatibility tests at the spacecraft level. This effort was time phased to be completed prior to the generation of the GPS Request for Proposal for the FY 1979 buy of satellites. Integrated functional and thermal vacuum tests using qualification model sensors has been performed. During FY 1978 a single channel IONDS receiving terminal was delivered by Ford Aerospace and specifications for the prototype operational receiving terminal (8 channel/8 satellite) were developed. During FY 1979 a positive decision was made relative to the incorporation of an IONDS flight payload on the GPS Qualification Test Vehicle (QTV) satellite. With that decision, integration of the IONDS payload onto the QTV was initiated and tests performed. Long lead items were procured for inclusion of IONDS on GPS satellites to be purchased in FY 1979.

During FY 1979, qualification testing of the IONDS payload on the GPS QTV were completed. Based upon these and prior test results, the decision to deploy IONDS on the full GPS constellation was made at the GPS Defense Systems Acquisition Review Council II in June 1979. The IONDS program was transferred to the General Defense Intelligence Program early in FY 1980 with the new program element 31357F. This transfer was recommended by OMB, supported by Air Force Intelligence, and agreed to by the Secretary of Defense in December 1979. The Director of Central Intelligence identified funding to support integration of the IONDS sensors on the GPS satellites but did not support funding for development and procurement of the IONDS user terminals or for development of the data cross-link subsystem.

Program Element: #31357F/12433F

Title: Integrated Operational NUDETS
Detection System (IONDS)

DoD Mission Area: General Defense Intelligence Programs, #312
Strategic Surveillance and Warning, #132

Budget Activity: Intelligence and
Communications, #5
Strategic Programs, #3

2. (U)FY 1981 Program: Design changes for the incorporation of IONDS on the GPS Phase II satellites will be developed and modifications will be made on unlaunched satellites, if required. These changes will be based on data collected from the Qualification Test Vehicle which will be launched late in FY 1981. A competitive selection of a contractor for development of the IONDS operational ground receiving terminal will be made and a contract awarded the winner early in FY 1982. The prototype terminal test and evaluation will be initiated in FY 1984. Program element 12433F was re-activated to support development of the data cross-link subsystem and development of the receiving terminal. The terminal will be designed to be compatible with the E-4B airborne command post and ground based command centers.
3. (U)FY 1982 Planned Program: Development of the prototype user terminal will be initiated during this year and preparations will continue for launch of IONDS sensors on GPS Phase II satellites, beginning late in the fiscal year. Development of the data cross-link will be completed during this year.
4. (U)FY 1983 Planned Program: User terminal development will continue as will launch of an IONDS sensor to complete launch of the Phase II block of satellites. Procurement and integration of cross-link units will be incorporated with the IONDS sensor units on each satellite.
5. (U)Program to Completion: This is a continuing program. Design and development activities are keyed to the GPS schedule. The Initial Operational Capability/Full Operational Capability will be achieved concurrently with deployment of the GPS satellite system.
6. (U)Milestones: Not applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33110F Title: Defense Satellite Communications System
 DOD Mission Area: Common User Communications, #323 Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT		24,037	33,094	40,300	32,100	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Satellite Communications System is a maturing, evolutionary Department of Defense system developed to provide super high frequency satellite communications for secure voice and high data rate transmissions. Defense Satellite Communications System satisfies the unique and vital national security communications requirements for worldwide military command and control, crisis management, intelligence and early warning detection data relay, treaty monitoring and surveillance information, and diplomatic traffic. Specifically, the Defense Satellite Communications System supports the National Command Authorities, the Worldwide Military Command and Control System, the Defense Communications System, the Diplomatic Telecommunications Service, the White House Communications Agency, Ground Mobile Forces, selected Allies, and other U.S. Government and Department of Defense agencies. The Defense Communications Agency is responsible for overall Defense Satellite Communications System program management, systems engineering, operational direction, and satellite communications architecture. The Defense Satellite Communications System program consists of: a space segment; a multi-user terminal segment of ground, airborne, and naval elements; and an operational control segment. The Air Force is responsible for acquisition, deployment, and operational support of the space segment. The authorized space segment is comprised of four operational and two spare satellites positioned in synchronous equatorial orbit over four geographical areas to provide global (less polar) coverage to 72° latitude. Existing Defense Satellite Communications System II satellites will be replenished with Defense Satellite Communications System III satellites in late CY 1984 which will provide increased channelization, flexibility, and electronic counter-countermeasure capability. In support of our nuclear capable strategic forces, Defense Satellite Communications System satellites will also include an ultra high frequency and, in the future, a super high frequency capability for emergency action message dissemination and force execution.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds to continue Defense Satellite Communications System III full scale development and satellite performance improvements. The second Demonstration Flight Satellite will complete acceptance testing and will be paired with the last Defense Satellite Communications System II satellite for a planned mid-1982 launch. First time integration associated with the transition from expendable launch vehicles to the Space Shuttle will continue. In addition, the solid state amplifier development, which is directed toward replacing low level traveling wave tube amplifiers, will be completed with a space qualified amplifier available

Program Element: #33110F

DOD Mission Area: Common User Communications, #323

Title: Defense Satellite Communications System

Budget Activity: Intelligence and Communications, #5

for integration on the first production satellites. An improvement program designed to enhance high level traveling wave tube amplifier reliability and efficiency will continue. Also, the Defense Satellite Communications System Phase III production satellite design baseline will be updated to ensure compatibility with revised Shuttle interface and environmental requirements. Earned on-orbit performance incentives, based on full scale development contract requirements, will be paid for the first developmental satellite launched during FY 1981. Also, additional satellite improvements that have the potential of significantly enhancing performance will be investigated. With the exception of orbital incentives, costs are based on contractor inputs, Federal Contract Research Center support requirements, and program office estimates for performance improvements.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	22,837	21,100	16,500		Continuing	Not Applicable
Procurement (missile)	17,300	93,040	113,253		Continuing	Not Applicable
(other)	5,958	21,886	40,705		Continuing	Not Applicable
(U) <u>OTHER APPROPRIATION FUNDS:</u>						
Procurement (missile) (Quantity)	17,300 (0)	80,489 (1)	129,964 (2)	211,646 (3)	Continuing (6)	Not Applicable (12)
Procurement (other)	5,965	6,278	2,220	2,872	Continuing	Not Applicable
Military Construction	0	4,820	4,260	1,229	Continuing	Not Applicable
Operation and Maintenance	5,132	8,732	11,997	11,893	Continuing	Not Applicable
Military Personnel	3,806	4,555	5,019	5,897	Continuing	Not Applicable

Program Element: #33110F

DOD Mission Area: Common User Communications, #323

Title: Defense Satellite Communications System

Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The need for an operational Super High Frequency satellite communications system to provide secure connectivity evolved as an outcome of satellite communications experiments conducted in the early-1960s when the Initial Defense Communications Satellite Program or Defense Satellite Communications System Phase I was approved. The Defense Satellite Communications System Phase I, originally intended as a research and development demonstration, provided limited operational point-to-point service between 1967 and 1973, confirming the importance and utility of satellite communications. However, several Phase I performance limitations, including channel capacity and orbital position drift (due to the sub-synchronous orbit), led to approval of Defense Satellite Communications System Phase II in 1969. Defense Satellite Communications System II satellites were developed to establish an operational Super High Frequency communications system to support military satellite communications requirements into the early 1980s. The authorized space segment consists of four operational and two in-orbit spare satellites. Based on validated and projected user requirements, the increasing dependency of high priority users, and the growing electronic countermeasures threat, the Defense Satellite Communications System III satellite concept was approved in 1974. The Defense Satellite Communications System III is the next generation in the evolution of communication satellite systems and is directed toward satisfaction of the wideband element of the Defense Communications Agency military satellite communications architecture. Defense Satellite Communications System III will provide a three fold increase in channelization; a unique spot, area, and earth coverage; and an improved anti-jam capability; and responsive adaptability in reallocating satellite communications assets (power and bandwidth) to satisfy dynamic user connectivity requirements in an electronic jamming and/or nuclear environment.

Major commitments have been made in the Defense Satellite Communications System terminal segment including heavy and medium terminals, as well as light terminals which will be reserved by the Joint Chiefs of Staff to support contingency operations. The Navy is acquiring Super High Frequency ship terminals and the Air Force has installed a Super High Frequency production terminal on the Advanced Airborne Command Post. In addition, about four hundred transportable light terminals for the Ground Mobile Forces will be employed to establish high capacity links within and between units of the Army, Air Force and Marine Corps during crisis or contingency situations. Analysis of future operational requirements and user mission dependency are being performed to define the Defense Satellite Communications System requirements and priorities through the end of this century. During this period, Defense Satellite Communications System II satellites will be replenished with Phase III satellites to support increased user requirements as the planned terminal segment becomes operational and user mission execution becomes more fully committed. Performance improvements and major system upgrades are expected as the threat and user requirements cause military exploratory and operational use of the Extremely High Frequency spectrum.

(U) RELATED ACTIVITIES: The Defense Communications Agency is responsible for overall Defense Satellite Communications System program management, system engineering, and satellite operational direction. Within the Defense Communications Agency, Military Satellite Communication System Office is responsible for the system architecture for all Defense satellite communications systems. The military departments are responsible for individual elements of the system. The Army budgets, develops, and procures ground terminals under Program Element 33142A, Defense Satellite Communications System. The Navy performs these functions for shipborne terminals under Program Element 33109N, Satellite Communications System.

Program Element: #33110F

DOD Mission Area: Common User Communications, #323

Title: Defense Satellite Communications System

Budget Activity: Intelligence and Communications, #5

In addition to its responsibility for the space segment, the Air Force develops and integrates airborne terminals under Program Element 64723F and Program Element 11312F, Advanced Airborne Command Post, and provides launch services for the Titan III launch vehicle under Program Element 35119F, Space Boosters. The Inertial Upper Stage, to be used for launch with the Titan II(34)D and Space Shuttle, is being developed by the Air Force under Program Element 63411F. Inertial Upper Stage procurement, Inertial Upper Stage recurring integration, and Space Shuttle launch support will be furnished under Program Element 35171F, Space Launch Support. Development of an Air Force Satellite Communications System Single Channel Transponder for incorporation on the Defense Satellite Communications System III Demonstration Flight Satellites is funded under Program Element 33601F. Defense Satellite Communications System is closely coordinated with the Advance Space Communications Program, Program Element 63431F, which evaluates, develops, and demonstrates evolutionary communication satellite technologies for future Defense communications satellite programs.

(U) WORK PERFORMED BY: The Air Force Space Division, Los Angeles, CA, is responsible for the space segment of the Defense Satellite Communications System. TRW, Redondo Beach, CA, is the prime contractor for the design, fabrication, test and integration of Defense Satellite Communications System Phase II satellites. The Martin-Marietta Corporation, Denver, CO, is the prime contractor for the Titan III launch vehicle. General Electric Company, Valley Forge, PA, and Hughes Aircraft Company, Culver City, CA, provided preliminary designs for the Defense Satellite Communications System Phase III satellite with General Electric selected for Phase III full scale development. Boeing Aerospace Division, Seattle, WA, is developing the Inertial Upper Stage. The Aerospace Corporation, El Segundo, CA, provides general systems engineering/technical direction to the Air Force Space Division System Program Office.

Program Element: #33110F

DOD Mission Area: Common User Communications, #323

Title: Defense Satellite Communications System

Budget Activity: Intelligence and Communications, #5

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: To demonstrate the feasibility of a military satellite communications system, twenty-six Initial Defense Communications Satellite Program satellites were placed in near synchronous orbit during 1966-1968 providing limited operational point-to-point service into 1973. The follow-on Defense Satellite Communications System II program, which was started in 1969, now provides an operational Super High Frequency military satellite communications system. Since 1971, a total of fourteen Defense Satellite Communications System II satellites have been launched with four failing to achieve orbit due to booster malfunctions. With the launch of a Defense Satellite Communications System II satellite pair in November 1979, the Defense Satellite Communications System Program achieved the authorized six satellite orbital configuration for the first time in its history. Defense Satellite Communications System orbital assets are currently deployed over four geographical areas to maintain global (less polar) coverage as follows: Defense Satellite Communications System II F4 positioned over the Indian Ocean; Defense Satellite Communications System II F8 located over the Western Pacific; Defense Satellite Communications System II F11 placed over the Eastern Pacific; Defense Satellite Communications System II F12 located over the Eastern Pacific as a spare; and Defense Satellite Communications System II F13 placed over the Atlantic Ocean. Defense Satellite Communications System II F7 has been designated as a spare/test satellite because of permanent loss of its narrow channel coverage capability and positioned over the Western Pacific. Defense Satellite Communications System II F14 has been repositioned over the Indian Ocean as a spare until completion of Air Force Satellite Control Facility Indian Ocean tracking station modifications and as a ready backup for the aging F4 satellite. The successful deployment and operation of Defense Satellite Communications System II satellites F11 and F12 in December 1978 allowed the North Atlantic Treaty Organization communications satellite, previously used over the Eastern Pacific to augment the Defense Satellite Communications System, to be returned to North Atlantic Treaty Organization and to be relocated to the Atlantic Ocean area. In December 1974, the Defense Systems Acquisition Review Council approved the preliminary design/definition phase for Defense Satellite Communications System III, and two contractors were selected to deliver competitive designs during 1976. Following a favorable Defense Systems Acquisition Review Council recommendation, the Deputy Secretary of Defense approved initiation of full scale development of Defense Satellite Communications System III in January 1977. In February 1977, the General Electric Company was selected to complete satellite design; to develop, test, and support the launch of two Demonstration Flight Satellites; to develop a refurbishable qualification model satellite; and to conduct and support on-orbit tests and evaluations. In addition, two Satellite Configuration Control Element engineering development models are being developed for eventual location to Air Force Satellite Control Facility and Fort Detrick, MD. Also, an Air Force Satellite Communications System Single Channel Transponder is being developed as an integral part of the Defense Satellite Communications System III design. In early FY 1980, the Defense Satellite Communications System III full scale development program experienced non-technical developmental problems which prevented the planned launch of the first Demonstration Flight Satellite by June 1980. A number of factors contributed to this delay including the contractor's underestimation of the development effort, inadequate manpower, insufficient test equipment, a continuing late delivery of key subcontractor components, and an unexpected number of problems encountered during the component qualification program. Based on these problems, the Defense Satellite Communications System III Program was initially rephased to start production in FY 1982 with eleven production satellites acquired: four each in FY 1982 and FY 1984; and three in FY 1986.

Program Element: #33110F

DOD Mission Area: Common User Communications, #323

Title: Defense Satellite Communications System

Budget Activity: Intelligence and Communications, #5

In the year preceding satellite acquisition, four sets of advance procurement were planned in FY 1981 and FY 1983 and three sets in FY 1985. However, because of uncorrectable funding deficiencies, the FY 1982 Program Decision Memorandum revised the production satellite procurement strategy from 1-4-0-4-0-3 (FY 1981- FY 1986) to 1-2-3-0-3-3 (FY 1981 - FY 1986). The single satellite in FY 1981 is the refurbished Defense Satellite Communications System qualification satellite.

This production delay and Congressional denial of funding in the FY 1980 Budget Request for additional Defense Satellite Communications System II satellites makes the gap associated with transitioning from a Phase II to Phase III satellite capability more acute. By early 1983, the probability of sustaining the minimum four satellite orbital configuration is projected to severely decline. This likely gap in coverage is expected to occur during the period when user requirements are rapidly increasing and dependency of critical users on the Defense Satellite Communications System will be almost total. Many users have no commercial communications alternatives and a lack of satellite coverage will jeopardize their mission execution and our national defense posture. In an attempt to partially mitigate this situation and assure continuity of coverage, the refurbishment of the Defense Satellite Communications System III qualification satellite has been expedited starting in FY 1980 with the procurement of advance buy. Originally, before production rephasing, the qualification satellite would have been refurbished in FY 1981 as one of the first four Defense Satellite Communications System III production flight satellites. This approach will make the refurbished qualification satellite available by mid-1983 as a replenishment asset.

Based on these rephased objectives, Defense Satellite Communications System III full scale development continued. The qualification satellite completed integration and started system level qualification testing. Assembly of the first Demonstration Flight Satellite was also completed and the satellite prepared for system level acceptance testing. A letter contract for advance buy for the early refurbishment of the qualification satellite was signed. First time engineering and integration efforts associated with transitioning from expendable launch vehicles to the Space Shuttle continued. In addition, the development of a solid state amplifier as a replacement for low level, traveling wave tube amplifiers continued.

2. (U) FY 1981 Planned Program: Defense Satellite Communications System III full scale development will continue and system level qualification satellite testing will be completed. On completion, the qualification satellite will be refurbished using FY 1981 missile procurement funds and made available for launch in mid-1983 as a gapfiller. The first Defense Satellite Communications System III full scale development satellite will complete acceptance tests and is planned to be launched in mid-1981 paired with a Defense Satellite Communications System II satellite. After their initial orbital checkout and testing, full scale development satellites will become operational elements of the Defense Satellite Communications System. The integration and testing of the second full scale development satellite will continue and corrective modifications, as necessary, will be designed and incorporated depending on the results of the first full scale development satellite orbital performance. Using the results of system level qualification satellite testing and, if feasible, an abbreviated operational test and evaluation program, a Defense Systems Acquisition Review Council Milestone III will be conducted in July to consider production approval. Contractual preparations have been initiated to allow satellite production to start by October 1981. In addition, to assure the most effective and efficient use of our resources, the FY 1981 and FY 1982 advance buy procurements for the first four production satellites have been consolidated and will be acquired in FY 1981. First time integration associated with the transition from expendable

Program Element: #33110F

DOD Mission Area: Common User Communications, #323

Title: Defense Satellite Communications System

Budget Activity: Intelligence and Communications, #5

launch vehicles to the Space Shuttle will continue. The solid state amplifier development will also be continued with performance evaluated using engineering and qualification models. A developmental improvement program designed to enhance high level traveling wave tube amplifier efficiency and reliability will be initiated. The production satellite design baseline will be updated to ensure compatibility with revised Shuttle interface and environmental requirements.

3. (U) FY 1982 Planned Program: The major Defense Satellite Communications System III full scale development should be completed with the second Demonstration Flight Satellite available for a planned mid-1982 launch paired with the last Defense Satellite Communications System II satellite. The refurbishment of the qualification satellite will continue toward an expected launch availability in mid-1983. As a result of either a Defense Systems Acquisition Review Council Milestone III or Secretary of Defense Decision Memorandum, the first two phase III satellites will be acquired based on the 1-2-3-0-3-3 (FY 81-FY 86) procurement strategy. The traveling wave tube amplifier production improvement program designed to enhance efficiency and improve reliability will be initiated coincident with Phase III production. Additional satellite improvements that have the potential of significantly enhancing performance will be investigated. Launch vehicle first time integration will also continue. In addition, the solid state amplifier development will be completed with a space qualified amplifier available for Shuttle integration on the first production satellites. The update of the production satellite design baseline for Shuttle compatibility should be completed. Earned on-orbit performance incentives will be paid for the first full scale development satellite. The increase in the Research, Development, Test and Evaluation FY 1982 estimate is attributable to: replacing existing launch vehicle first time integration; the addition of a new first time integration for the Titan III(34)D/transtage; development contractor integration support; and the need for Phase III design modifications to assure interface and environmental compatibility with revised Shuttle/Inertial Upper Stage requirements. For the missile procurement appropriation, the FY 1982 estimate is increased due to the impact of revised escalation indices and the consolidation within the Defense Satellite Communications System Program Element, Air Force Satellite Communications System funding designated for the Defense Satellite Communications System Single Channel Transponders.

4. (U) FY 1983 Planned Program: Three additional Defense Satellite Communications System III satellites will be acquired and the production of the first two Phase III will continue. The qualification satellite will complete refurbishment and be available in mid-1983 as a partial gapfiller. The first time integration effort required for transiting launch capability to the Shuttle will also continue. Earned on-orbit performance incentives will be paid for the two full scale development satellites. In addition, the investigation of satellite performance improvements will be continued.

5. (U) Program to Completion: Production of the first five Defense Satellite Communications System Phase III satellites will continue. Three additional production satellites will be acquired each in FY 1985 and FY 1986 with advance buy for at least three satellites procured in FY 1984. The first two production satellites should be available for a Shuttle launch by September 1984, with Shuttle first time integration completed by FY 1985. The Air Force, in conjunction with the Defense Communications Agency/Military Satellite Communications System Office will plan and investigate developmental efforts to provide a future satellite communications capability at Extremely High Frequency.

Title: Defense Satellite Communications System
 Budget Activity: Intelligence and Communications, #5

Program Element: #33110F
 DOD Mission Area: Common User Communications, #323

6. (U) Milestones:

Defense Satellite Communications System II

Initial Contract Award (F1 - F6)
 Initial Satellite Launch (F1 - F2)
 Award contract for replenishment satellites (F7 - F12)
 Award contract for additional satellites (F13 - F16)
 Last Launch (F13 - F14)
 Remaining launches - F15
 - F16

Defense Satellite Communications System III

Defense Systems Acquisition Review Council -
 (approval for preliminary design)
 Award Phase I (Preliminary Design) Contracts
 Preliminary Design Review
 Defense Systems Acquisition Review Council II - (Full Scale
 Development Decision)
 Award Phase 2 (Engineering Development) Contract
 Launch First Demonstration Flight Satellite
 Defense Systems Acquisition Review Council III-
 Production Decision
 First production satellite launch
 Refurbished qualification satellite launch available

*Date presented in FY 1980 Descriptive Summary

1/ Production decision date changed based on Assistant Secretary of Defense Communications, Command, Control
 and Intelligence tentative planning for an earlier Phase III satellite production start.

2/ Launch date changed based on a re-estimation of refurbishment and a Defense Communications Agency launch
 requirement.

DATE

Mar 1969
 Nov 1971
 Oct 1974
 Jul 1976
 Nov 1979
 Jun 1981
 Jun 1982

DATE

Dec 1974
 Dec 1975
 Oct 1976
 Dec 1976
 Feb 1977
 Jun 1981
 Jul 1981 1/
 Dec 1984
 Jul 1983 2/
 *(Dec 1981)
 *(Sep 1983)

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

Test and Evaluation Data

1. (U) Development Test and Evaluation: Development Test and Evaluation for the Defense Satellite Communications System II Space Segment is complete. For the Defense Satellite Communications System III, development test and evaluation is separated into two distinct phases which are coincident with the Defense Satellite Communications System III development. During Phase One, which extended from Defense Systems Acquisition Review Council I in December 1974 to Defense Systems Acquisition Review Council II in December 1976, development tests were conducted to demonstrate that technical risks had been minimized and that the satellite was "buildable". During Phase Two, which extends from Defense Systems Acquisition Review Council II through Defense Systems Acquisition Review Council III in July 1981, the design will be translated into a developmental satellite with performance verified through a series of component, subsystem, and system level qualification satellite tests.

(U) In December 1975, two contractors were selected to accomplish the Defense Satellite Communications System III preliminary design and perform development tests to evaluate their satellite design concepts. These tests identified critical design areas, including component environments, and were used to verify the adequacy of design approach by evaluating failure modes, margins, and performance over a range of operating conditions. The Phase One objective was to identify design problems early so that corrective action could be taken, and to provide a high level of confidence in the ability of the hardware to meet requirements. Tests constituted a demonstration of the adaptation of already-proven concepts and techniques. The development test program proceeded from parts, materials, and processes to breadboard/brassboard tests on circuits and subassemblies. Also, selective testing of engineering critical items in each proposed subsystem was performed and included, among others, the Multiple Beam Antenna, the Beam Forming Network, Traveling Wave Tube Amplifiers, Super High Frequency transponders, Attitude Control System electronics, Earth sensors, and the solar array deployment mechanism. Results of the Phase One test program were included in the respective contractors' preliminary design review. Performance and electrical characteristics of piece parts such as diode transistors, integrated circuits, hybrids, crystals, variable resistors and capacitors, were evaluated under the following conditions: thermal cycling, shock, accelerated life, mechanical environments, and survivability. Selective components and subsystems were evaluated using various tests. Multiple Beam Antenna components were tested functionally and evaluated after vibration, thermal cycling, and during thermal vacuum tests. The Multiple Beam Antenna engineering model performance was also evaluated to include critical array component stability during thermal cycling. Component

Budget Activity: Intelligence and Communications, #5

Program Element: #33110P, Defense Satellite Communications System

survivability testing was conducted to determine the ability of components to perform in a nuclear environment. The results of these piece part tests allowed the selection of adequately hardened piece parts, utilization of most effective circuit designs, and optimized shielding to prevent function upset/outage, circuit burnout, or piece part degradation which would negate mission capability.

(U) At the completion of the preliminary design effort, General Electric Company, Space Division, was selected to proceed with full scale development and Phase Two testing following Defense Systems Acquisition Review Council II in December 1976 and Deputy Secretary of Defense approval in January 1977. The objective of Phase Two Development Test and Evaluation during full scale development (February 1977-December 1981) is to continue with sufficient developmental testing to complete design and attain the highest confidence in Defense Satellite Communications System III Demonstration Flight Satellite performance. Phase Two testing is divided into three parts: in-plant, launch base, and on-orbit. The in-plant test program which provides the performance baseline for production, consists of a combination of: developmental testing using thermal, structural, and development models; piece part, component and subsystem qualification testing; and extensive, systematic system level qualification model satellite tests to confirm total design integrity in a realistic, simulated orbital environment; and acceptance testing of the two Defense Satellite Communications System III Demonstration Flight Satellites to verify manufacturability and performance against design baseline. This testing will be incremental and will establish performance confidence as satellite integration proceeds. During launch base testing, each Demonstration Flight Satellite will be tested to verify its launch readiness. Subsequent to launch, on-orbit testing will consist of three distinct sequential elements to determine if launch caused damage: (1) immediate post-injection evaluation of the performance of satellite support subsystems conducted by the Air Force Space Division via the Air Force Satellite Control Facility; (2) verification of communications subsystem and Super High Frequency tracking, telemetry, and command performance via the Camp Parks radiometric test terminal; and (3) evaluate interoperability with varied Defense Satellite Communications System and non-Defense Satellite Communications System earth terminals and compatibility with the Satellite Configuration Control Element. The third test element will be managed by the Defense Communications Agency Defense Satellite Communications System Program Manager.

(U) In-plant testing is complete on the thermal, structural, and development test models. Using the structural model, which is identical to the Demonstration Flight Satellite and qualification satellite, a modal survey, solar array deployment and integrity, acoustic, and static load tests were performed. The qualification satellite communications payload and antennas, the 19-beam Multiple Beam Antenna and the 61-beam Beam Forming Network completed qualification and range testing. The following components, among others, completed qualification tests and are integrated into the qualification satellite: the North Panel Power

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Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System

Controller, South Panel Power Controller, Ordnance Controller, Shunt Dissipators, batteries, power regulator unit, solar array, electrical harnesses, thermal heaters, thermal blanket supports, command telemetry unit, remote telemetry unit, beacons, Super High Frequency down-converters, intermediate frequency down-converter, attitude control electronics, sun sensor, rate gyros, earth sensor, reaction wheels, among others. The results of the North Panel qualification tests verify that performance meets or exceeds some specification requirements. The 19-beam Multiple Beam Antenna and gimbal dish antenna qualification test results also meet or exceed specification requirements.

(U) System level qualification satellite testing started in June 1980 and will continue through January 1981. The Qualification Test Satellite will be subjected to electromagnetic compatibility tests, acoustic, pyro shock, thermal balance, and thermal vacuum environmental tests. The qualification satellite has completed system level integration, radio frequency compatibility and electrical system baseline tests. It is currently in thermal vacuum test with a planned completion in late October 1980. The results of completed tests indicate that demonstrated performance meets specification requirements. The overall test objectives required to qualify the design are:

- (1) Verification that the satellite and its associated subsystem meet design performance characteristics.
- (2) Verification of the design performance and compatibility of all subsystems for normal and backup modes of operation which are representative of mission usage.
- (3) Demonstration of the design compatibility of the satellite with all electrical and mechanical support equipment in support of spacecraft level integration and test at the factory and launch base.
- (4) Demonstration of the operability and functional performance of normally operating satellite subsystems and components during environmental conditions more severe than may be encountered in the launch, transfer orbit, and synchronous orbit phases of the mission.
- (5) Verification that the satellite and associated subsystems survive exposure to the overstressed environment conditions and meet the design performance characteristics.
- (6) Verification that the satellite and associated subsystem operational performance are not detrimentally affected and survive the spacecraft charging, electromagnetic pulse, and system generated electromagnetic pulse.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellite Communications System (DSCS)

- (7) Verification of the final thermal analytical modeling of the satellite.
- (8) Demonstration of the design compatibility between the satellite and software systems.
- (9) Development of the procedures and demonstration of the adequacy of these procedures for the handling, transportation, assembly, integration, and testing of the flight satellites.
- (U) All complementary subsystems for the first Defense Satellite Communications System III Demonstration Flight Satellite completed acceptance tests and are integrated in the satellite. System level acceptance testing started in July 1980 and will continue through March 1981. This satellite and the second Demonstration Flight Satellite will be subjected to a similar sequential series of tests as the qualification satellite, but test limits will be lower. The first Demonstration Flight Satellite completed system level integration, radio frequency compatibility and electrical system baseline tests. It also completed acoustic tests which identified several technical deficiencies. These deficiencies are being corrected and thermal vacuum tests have been rescheduled to start in late January 1981. The results of completed tests indicate demonstrated performance meets specification requirements. On completion of in-house acceptance tests, the first Demonstration Flight Satellite will be paired with Defense Satellite Communications System II F15 for a July 1981 launch.

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Budget Activity: Intelligence and Communications, #5

Program Element: #33110F, Defense Satellites Communications System

3. (U) System Characteristics:

<u>Technical Characteristics</u>	<u>Objective</u>	<u>Current Estimate</u>	<u>D/ Demonstrated</u>
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Frequency (Gigahertz)	7.25-8.4	7.25-8.4	
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Bandwidth (Megahertz per channel)	50-85	50-85	
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Effective Isotropic Radiated Power (decibels)

a. Channels 1 & 2 (EC/Spot/AC(Dish)) <u>A/</u>	29/39/43	29/40/44	
b. Channel 3 (EC/EC/Spot)	24/23/33	25/24/34	
c. Channel 4 (EC/EC/Spot/AC(Dish))	24/23/33/37	25/24/35/39	
d. Channels 5 & 6 (EC)	24	25	
e. Beacons (EC)	11	12	

Signal Gain to System Noise

Temperature Ratio E/

a. Earth Coverage Horn	-15	-13	
b. Earth Coverage MBA <u>B/</u>	-16	-15	
c. Spot MBA	-1	-0.5	

Nulling (decibels below EC reference)

Receive MBA C/

A/ EC - Earth Coverage; Spot - 1.0° minimum diameter; AC - Area Coverage; Dish - 3.5° beam diameter switchable on orbit to desired channel.

B/ MBA - Multiple Beam Antenna

C/ Based on a single null anywhere in the satellite field of view created within a MBA earth coverage pattern.

D/ Demonstrated performance will be based on the results of system level qualification satellite testing.

E/ Decibels per Degree Kelvin.

Budget Activity: Intelligence and Communications, #5

Program Element: #33110P, Defense Satellite Communications System

<u>Operational Characteristics</u>		<u>Objective</u>	<u>Current Estimate</u>	<u>Demonstrated</u>
1. Quantities (per satellite)				
a.	40 Watt TWTAs A/ (Channels 1 and 2)	2	2	
b.	10 Watt TWTAs (Channels 3 thru 6)	4	4	
c.	SHF Command Links	2	2	
d.	Protected Beacons	2	2	
2.	Satellite Reliability B/	.7	.7	
3.	Launch Vehicle (types) C/	Titan IIIC Titan IIID/IUS STS/IUS	Titan IIIC Titan IIID/IUS STS/IUS	
4.	Weight (lbs) D/	1650	1876	
A/ TWTAs - Traveling Wave Tube Amplifier				
B/ Probability of survival at 7 years				
C/ IUS - Inertial Upper Stage: STS - Space Transportation System (Space Shuttle)				
D/ On-orbit satellite weight less expendables (dry weight)				

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33126F

Title: Long Haul Communications - DCS

DOD Mission Area: Common User Communications, #323

Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	TITLE	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL PROGRAM ELEMENT							
1144	Automated Technical Control	7,845	11,380	8,200	8,900	Continuing	N/A
2022	Automated Digital Communications Processing	504	488	Project Cancelled			
		1,886	3,801	2,812	2,983	Continuing	N/A
2155	Systems Control	2,065	3,490	2,592	2,987	Continuing	N/A
2157	Transmission Improvements	3,190	3,101	2,496	2,480	Continuing	N/A
2206	Digital European Backbone	200	200	200	150	150	1,628
2440	Secure Voice Improvements Program		300	100	300	Continuing	N/A

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This element is the United States Air Force portion of the Tri-Service RDT&E program for the Defense Communications System. The Defense Communications System provides the long haul, point-to-point, and switched network telecommunications needed to satisfy requirements of the National Command Authorities, the Department of Defense and certain other Government agencies. The Defense Communications System RDT&E program is structured to define system and subsystem architecture, specify design parameters, and develop telecommunications technology for Defense Communications System modernization and improvement. Work in this element provides the equipment for an orderly transition to a unified second generation Defense Communications System (1985) and determines the architecture for the third generation Defense Communications System. It includes technology development and subsystem implementation in the areas of automated digital communications processing and distribution techniques, performance assessment and networks management improvements, and transmission improvements.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds to develop an Automatic Digital Network Phase II multi-network gateway to interconnect that system with other data networks, to integrate control features of digital transmission upgrades into the overall Defense Communications System's system control structure, and to develop improved transmission subsystem equipment. Costing estimates were formulated by the Electronic Systems Division, Hanscom Air Force Base, MA; and the Rome Air Development Center, Rome, NY.

Program Element: #33126F

Title: Long Haul Communications - DCS
Budget Activity: Intelligence and Communications, #5

DoD Mission Area: Common User Communications, #323

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E TOTAL PROGRAM ELEMENT	8,000	11,400	9,900		Continuing	N/A
1144 Automated Technical Control (ATEC) *	659	608	416		108	18,067
2022 Automated Digital Communications Processing	2,236	3,801	3,160		Continuing	N/A
2155 Systems Control	2,065	3,490	3,114		Continuing	N/A
2157 Transmission Improvements	2,840	3,001	2,910		Continuing	N/A
2206 Digital European Backbone (DEB)	200	200	200		300	1,640
2440 Secure Voice Improvements Program (SVIP)		300	100		Continuing	N/A
Procurement, Other	2,400	3,562	9,682			52,930
Project 1144 (ATEC)	2,127	13,100	14,237			72,321
Project 2206 (DEB)	5,330	2,900	2,530		Continuing	N/A
Project 2440 (SVIP)						
Military Construction						
Project 2206 (DEB)			2,450		3,250	7,740

(U) OTHER APPROPRIATION FUNDS:

Other Procurement						
Project 1144 (ATEC)	2,041	3,692			Cancelled	
Project 2206 (DEB)	2,055	13,100	7,920	9,300		72,000
Project 2440 (SVIP)	4,297	3,005			Continuing	N/A
Military Construction						
Project 2206 (DEB)			610	2,804	2,950	8,364

* Project cancelled, first quarter FY 1981.

Program Element: #33126F

DoD Mission Area: Common User Communications, #323

Title: Long Haul Communications - DCS
Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: Project 2022 Automated Digital Communications Processing. As the Defense Communications System transitions to an all digital system, three units are required to provide service which meets customer needs. These units will be designed and tested under this project. First, a centralized service facility will emulate features of existing Automatic Digital Network switches. Second is a gateway element which will provide the interface between the Defense Communications System and other digital networks. The ability to connect the Defense Communications System to other digital networks will provide significant cost savings and more timely information exchange between Defense and non-Defense customers. Third is a feasibility demonstration of features such as automated based distribution (electronic mail), digital facsimile, and word processing. The purpose of this demonstration is to assess potential cost savings and manpower reductions accruing from their use.

(U) Project 2155 System Control. The purpose of this project is to develop system control techniques, algorithms, and hardware and software specifications which provide automated traffic reroute and restoral worldwide. Basic data on traffic loading will come from Defense Communications System switches. System control equipment will improve Defense Communications System traffic management effectiveness by more than thirty percent.

(U) Project 2157 Transmission Improvements. The objective of this project is to improve transmission survivability, efficiency, capacity, and reliability of Air Force and Defense Communications System communication links by operational application of new transmission techniques such as millimeter wave and fiber optics, and by developing transmission equipment embodying new techniques and technology.

(U) Project 2206 Digital European Backbone. Under this project, a digital transmission system is being installed in four phases in Europe (Coltano, Italy to England). Digital European Backbone is a follow-on to the prototype digital transmission system now in operation between Frankfurt and Vaihingen. Digital European Backbone equipment replaces obsolete analog equipment, improves security, and increases capacity. It is the first major digital transmission subsystem in the Defense Communication System. The initial phase of the Digital European Backbone was completed in November 1979.

(U) Project 2440 Secure Voice Improvement Program. The Secure Voice Improvement Program was restructured in accordance with FY 1979 Congressional guidance. This project supports the Defense Communications Agency's program outlined in its Five Year Plan.

(U) RELATED ACTIVITIES: The Digital European Backbone project (2206) involves tri-Service funding. It involves installation of equipment at Army, Navy, and Air Force sites. Overall program management for this project is exercised by the Defense Communications Agency through appropriate Management Engineering Plans. The remaining four projects (2022, 2155, 2157, and 2440), are part of the coordinated Defense Communications System RDT&E program as directed by the DCA Five Year Program. Each Service programs funds to support work directed by the Defense Communications System Plan.

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DOD Mission Area: Common User Communications, #323

Title: Long Haul Communications - DCS

Budget Activity: Intelligence and Communications, #5

(U) WORK PERFORMED BY: Air Force Systems Command manages this program element through the Electronic Systems Division, Hanscom Air Force Base, MA, (Project 2206, and 2440) and the Rome Air Development Center, Rome, NY, (Projects 2022, 2155, and 2157). Contractors for Rome Air Development Center projects are: GTE Sylvaia, Needham, MA, (Automated Communications Performance Monitoring and Assessment); Harris Corporation, Melbourne, FL, (16 Kilobit Per Second Modulator/demodulator); Softech, Waltham, MA, (Higher Order Language Investigation); and Ford Aerospace and Communications Corporation, Palo Alto, CA, (Advanced Research Project Agency Network/Automated Digital Network II Gateway).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments:

(U) Project 2022: The two/four Wire Digital Subset (digital telephone) and associated digital converter evaluation was successfully completed. These telephones can use unmodified analog base cable plants to provide the same quality digital voice service normally obtained on four wire instruments. Work continued on the Communications Oriented Language and communications software package developments.

(U) Project 2155: Work continues on the automated digital fault isolation algorithm and the automated channel reconfiguration model. Work also continues on electronic counter-countermeasures isolation techniques.

(U) Project 2157: The 16 Kilobit Per Second data modulator/demodulator with secure voice terminal full scale engineering development continues towards a low rate initial production decision. The advanced development model of the associative communications multiplexer evaluation continues.

(U) Project 2206: Research and Development funding for program office implementation and test support continued. Final Operational Capability of Stage I (Coltano, Italy to Vaihingen, Germany) occurred in November 1979. Equipment installation at Stage II sites (central Germany, north to Schoenfeld) began.

2. (U) FY 1981 Program:

(U) Project 2022: Development of a new higher order language (JOVIAL) compiler and a communications software development package will be completed. These two efforts will provide the Air Force and the Department of Defense with (1) a higher order language with some selected changes specifically oriented towards meeting real time communications processing requirements, and (2) cost reductions in developing and maintaining software. Continue development of another higher order language (Ada) compiler (with inputs from the JOVIAL efforts described above) with communications processor requirements included. This universal Department of Defense compiler will be evaluated on an experimental switching node at Rome Air Development Center. Continue Experimental Integrated Switched Network development. Rome Air Development Center is modifying an experimental switch to provide a satellite link connecting it with four other nodes. Live experiments will then be conducted to gather data for the future Defense Communications System Integrated Switching Node. Continue Automated Digital Network II gateway development. This effort will provide a microprocessor implemented

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Title: Long Haul Communications - DCS

DoD Mission Area: Common User Communications, #323

Budget Activity: Intelligence and Communications, #5

switch to interface the two different protocols and hand-shaking procedures used in these two networks. Begin development of the Automated Digital Network II multi-network gateway, building on the previously mentioned gateway. This will provide additional needed interoperability between the Automated Digital Network II and other networks that use different protocols/message formats. Security protection is a major consideration in this effort. Begin a secure electronic mailbox demonstration program to provide end-to-end security for Automated Digital Network customers.

(U) Project 2155: Complete Rome Air Development Center evaluation of the Automated Digital Fault Isolation Algorithm and define tasks for its transition. Complete competitive evaluation of the Adaptive Channel Estimation radio monitoring techniques and identify specific requirements for a prototype. Produce interoperability definition and architecture for a cooperative system control between the Defense Communications System and Tactical Systems. Continue work towards system control integration of satellite systems with Defense Communications System terrestrial architecture. Continue development of electronic countermeasures signal detection and discrimination capability. Begin work on development of a fault detection/isolation system for user and access areas. Begin efforts for the definition of future unified digital technical control concepts. Continue development of a channel reconfiguration model and associated technical control terminals for radio circuit restoral via digital patching.

(U) Project 2157: Complete development of the 16 Kilobit Per Second Modem/secure voice terminal, with Initial Operational Test and Evaluation conducted at four operational state-side locations, and transition to low rate initial production. Terminals will provide urgently needed high quality narrowband secure voice capability over dialed-up circuits. Award contract for development of digital channel efficiency model which, via data compression techniques, may double channel capacity of selected radio systems and permit direct, efficient interoperability between United States and North Atlantic Treaty Organization/Allied communications systems at high data rates. Complete live experiments on the Rome Air Development Center tropospheric scatter test range to provide a data base for multipath effects and to determine terrain effects on electronic counter-countermeasure nulling. Data is critical for establishing emergency backup tropospheric scatter communications under crisis situations. Complete evaluation of three experimental subsystems that will incorporate different precise timing dissemination techniques. Such a subsystem will provide the Defense Communications System with timing and synchronization independent of any external timing source and is essential for the future digital Defense Communications System operation with digital switching.

(U) Project 2206: Research and Development funding for program office implementation and test support will continue. Equipment installation at Stage II sites will continue.

(U) Project 2440: Acquire initial production units of the AN/GSC-38 modulator/demodulator and interfaces to operate over the Automatic Voice Network.

3. (U) FY 1982 Planned Program:

(U) Project 2022: No new starts are planned in FY 1982 and FY 1983 due to funding restrictions in those years and funding requirements of ongoing projects. Complete development and installation of the Experimental Integrated Switched Network

Project Element: #33126F

DoD Mission Area: Common User Communications, #323 Title: Long Haul Communications - DCS
Budget Activity: Intelligence and Communications, #5

node and begin gathering experimental data. Continue Ada compiler, multinet gateway, and electronic mailbox efforts.

(U) Project 2155: No new starts are planned in FY 1982 and FY 1983 due to funding restrictions in those years and funding requirements of ongoing projects. Continue development of user access area fault isolation system. Demonstrate Automatic Voice Network control improvements in Europe at two sites. Perform comparative evaluation of Air Force developed channel reconfiguration unit and commercial version to provide definition of full scale development requirements. Complete definition of satellite interface for system control. Continue efforts leading to unified technical control concepts.

(U) Project 2157: Complete advanced development of digital channel efficiency model and transition to full scale engineering development. Complete field evaluation of electronic counter-countermeasures tropospheric scatter modulator/demodulator to provide jamming protection for tropospheric scatter signal processing (modulation) over long haul circuits. Continue development of adaptive tropospheric scatter processor. This equipment will also provide jamming protection through effective use/control of antenna nulling techniques. Complete development of radio and antenna techniques to provide jamming protection for terrestrial digital microwave line-of-sight systems. Experimental model will be provided to work with the Digital European Backbone I radio equipment.

(U) Project 2206: Research and Development funding for program office implementation and test support will continue. Work will continue on Stage II sites (central Germany, north to Schoenfeld). Stage IV construction will begin. Stage III planning continues.

(U) Project 2440: Efforts will continue in support of Defense Communications Agency's Secure Voice Improvement Program.

4. (U) FY 1983 Planned Program:

(U) Project 2022: Continue multinet gateway effort. Complete initial set of Experimental Integrated Switched Network experiments. Complete evaluation of Ada compiler on Rome Air Development Center integrated switching node to determine how well Ada will meet real time switching requirements. Complete laboratory demonstration only, of secure electronic mailbox. Field demonstration must be delayed due to funding limitations.

(U) Project 2155: Complete development of the performance monitoring and assessment system for user and access areas. Demonstrate electronic countermeasures signal identification and discrimination capability for rapid identification of jamming signals. Complete system-wide demonstration of Automatic Voice Network system control improvements at ten European sites and begin transition to production. Complete comparative evaluation of channel reconfiguration unit to define applicability to the Defense Communications System. Begin hardware and software development of interface units for Defense Communications System/Tactical system control interoperability. This project was delayed due to previous funding restrictions. Begin development of technical control for the future Defense Communications System.

(U) Project 2157: Integrate the tropospheric scatter electronic counter-countermeasures modulator/demodulator and the adaptive electronic counter-countermeasures processor for antenna nulling control to provide high jamming resistance over

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Program Element: #33126F

DoD Mission Area: Common User Communications, #323

Title: Long Haul Communications - DCS

Budget Activity: Intelligence and Communications, #5

tropospheric scatter circuits. Begin advanced development of new line-of-sight electronic counter-countermeasures radio using technology proven in prior development. Begin advanced development of the timing distribution subsystem to optimize and refine the selected timing dissemination technique. Start of this effort will have been delayed one year due to funding restrictions.

(U) Project 2206: Research and Development funding for program office implementation and test support will continue. Nineteen links of Stages II and IV will achieve final operational capability by early FY 1983. Additional Stage IV work continues. Stage II planning continues.

(U) Project 2440: Efforts will continue in support of Defense Communications Agency's Secure Voice Improvement Program.

5. (U) Program to Completion: This is a continuing program responsive to the Defense Communications Agency's Tri-Service program for the Defense Communication System. The implementation project, (2206 - Digital European Backbone), which define system and subsystem architecture, specify design parameters, develop telecommunications technology, and provide the hardware and software required for DCS modernization and improvement.

6. (U) Milestones: N/A

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #33144F

DOD Mission Area: Other Support Programs, #325

Title: Electromagnetic Compatibility Analysis Center (ECAC)
Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING: (\$ in thousands))

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
	TOTAL FOR PROGRAM ELEMENT	5,690	6,000	7,000	7,500	Continuing		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense Center operated by the Air Force. The creation of the Center stemmed from recognition that action was required to cope with the increasing number and severity of electromagnetic compatibility problems. The Center is tasked with the responsibility of developing a communications-electromagnetic systems data base and the analysis tools necessary to determine if these systems will operate in their intended electromagnetic environment. This program element provides core funding to support data base and analysis capability development as well as specific analyses requested in support of the Secretary of Defense and the Joint Chiefs of Staff. Analyses performed in support of Department of Defense component's operational and developmental systems are performed on a user reimbursement basis. Reimbursement accounted for 61% of the total ECAC operating costs in FY 80, the last year for which data is available.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The requirement for electromagnetic compatibility analysis in increasing because of the growing number and complexity of communications-electronics systems. This program will develop and maintain improved analytical tools and data bases and make these capabilities available to all Department of Defense users. Examples of the wide variety of systems which will be supported in FY 1982 include the Division Air Defense Gun System, F-18 Fighter/Attack Aircraft, Joint Tactical Information Distribution System, National Emergency Airborne Command Post E-4B Aircraft and Marine Corp digital wideband transmission system. In addition, this program will support the Secretary of Defense and Joint Chiefs of Staff in spectrum allocation/assignment and special electromagnetic compatibility analysis projects. The estimated costs are based on past program experience, adjustments for expected cost growth and projected workload to support the above projects.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
	5,600	6,000	6,600		Continuing		

(U) OTHER APPROPRIATIONS FUNDS:

Operation and Maintenance

3,500 3,700 4,200 4,500 Continuing Not Applicable

Program Element: #33144F

DOD Mission Area: Other Support Programs, #325

Title: Electromagnetic Compatibility Analysis Center (ECAC)
Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: The Electromagnetic Compatibility Analysis Center (ECAC) is a Department of Defense (DoD) facility established to provide advice and assistance on electromagnetic compatibility (freedom from radio interference) problems to the Secretary of Defense, Joint Chiefs of Staff, the military departments and other DoD components. The Center, at Annapolis, MD, is managed by the Air Force, but is available to all DoD users. The Chairman of the Joint Chiefs of Staff, and the Assistant Secretary of Defense for Communications, Command, Control and Intelligence jointly provide policy guidance, assign projects and establish project priorities. The Center consists of an Air Force Commander, Deputies for Army, Navy, Marine Corps, Air Force, and Special Projects, and an in-house technical management staff assisted by a contractor. The Center's primary function is the analysis of inter-system and system-to-environment electromagnetic compatibility. The purpose of these analyses is to determine whether Department of Defense communications-electronics (C-E) systems, in use or under development, will operate in current and projected electromagnetic environments. These analyses include consideration of the impact of the expected electromagnetic environment on both civilian and military telecommunications equipment and consideration of efficient use of the available frequency spectrum to enhance spectrum management. Other analyses performed are those on frequency allocations and assignments in support of the frequency management in the military departments and the Unified and Specified Commands. To perform the required analyses, the Center maintains and develops basic analysis techniques including models, prediction analyses systems and special techniques. In addition to the analysis techniques, the Center maintains and develops an extensive environmental data base which contains millions of pieces of data to perform the electromagnetic compatibility analyses. The data base files include information on the location and operating characteristics of United States and foreign equipment and systems, the equipment complements of specific vehicles or platforms (ships, army units, aircraft, etc.), the allocation and use of the frequency spectrum and all associated United States and international rules and regulations, digitized topographic data (U.S. and other nations), and future equipment and systems in development or conceptual stages. The Center also provides the necessary facilities to perform its mission. This includes computer rental and operations, administrative support, purchased supplies and services, building rental and contract functions. The Research, Development, Test and Evaluation funds primarily provide for development and maintenance of the analytical capabilities, development of additional data base requirements and government support. The Operation and Maintenance funds primarily support operational analysis projects of the military services and data base maintenance.

(U) RELATED ACTIVITIES: The Center performs electromagnetic compatibility analysis for major Department of Defense communications-electronics systems. These system analysis projects are funded by reimbursements from users. These reimbursed funds are estimated to be \$19.6 million in FY 1981, \$18.8 million in FY 1982 and \$19.4 million in FY 1983. In FY 1980, for example, more than 205 separate projects for the Army, Navy, Marine Corps and Air Force were supported. In addition, approximately 50 other Department of Defense, joint agency, and other Federal agency projects will be addressed by the Electromagnetic Compatibility Analysis Center. Examples of the systems being analyzed are: Air Force - E-3A and E-4B Aircraft, Joint Tactical Information Distribution System, Air Force Strategic Satellite System and Global Positioning System; Army - Communications Command Systems, Division Air Defense Gun System, Position Location Reporting System and US ROLAND; Navy - F/A-18-Aircraft, Special Electromagnetic Interference Project, Surface Missile

Program Element: #33144F

DOD Mission Area: Other Support Programs, #325

Title: Electromagnetic Compatibility Analysis Center (ECAC)

Budget Activity: Intelligence and Communications, #5

System, and PHALANX; and Marine Corps - tactical communication electromagnetic compatibility analysis and operational support to the Marine Corps. Efforts of mutual concern to the Department of Defense and other Federal agencies (i.e., Federal Communications Commission, Federal Aviation Administration) include projects such as the Microwave Landing System, Air Traffic Control Frequency Assignment System, Air-Ground-Air Frequency Assignment Program and Communications and Control Systems. The Center also exchanges data, math models, and computer programs with other agencies involved in frequency management such as the Department of Commerce, Interdepartmental Radio Advisory Committee, and the Office of Telecommunications Policy.

(U) WORK PERFORMED BY: The Electromagnetic Compatibility Analysis Center is located in Annapolis, MD. The contracting responsibility is performed by Headquarters, Air Force Systems Command through the Electronic Systems Division, Hanscom AFB, MA. The current contractor is the IIT Research Institute, Chicago, IL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In recent years, the program element funding provided the operation, maintenance administration, updating of data, and the continued development of electromagnetic capability analysis. Timely short term responses to operational problems for Southeast Asia, Europe and the Continental United States were provided. Frequency assignment analyses have been continuous. Analyses of equipment, proposed or in research and development, have been documented in technical reports. Beginning in FY 1973, the Frequency Resource Record System provided major frequency record keeping functions for several Unified and Specified Commands. With this system, worldwide frequency utilization of the Commands is maintained at the Center to provide quick response assistance to the operational forces on frequency utilization questions. Other work included continued development, updating and maintenance of the data base and advanced mathematical modeling to simulate characteristics of new types of receivers, transmitters and circuits.

(U) During FY 1975-1980 data base maintenance and outputs continued and software updating improved efficiency. The Frequency Resource Records System continued operational test in support of most of the Unified and Specified Commands. Emphasis was on analyses of equipment and systems in the development phase. Mathematical models were developed for new types of modulation and new scenarios. Electromagnetic compatibility systems analysis was performed and continuation of Center outputs such as data base, operational analysis support, Frequency Records Resource System (FRRS), and frequency allocation and assignment assistance was provided.

(U) Model development included improvement of the high frequency (HF) skywave and antenna models, satellite propagation, frequency division multiplex/frequency modulated models, conventional radar antenna models, system modeling and prediction analysis system models. The Center analyzed and formulated the Department of Defense and Service's positions relative to the General Worldwide Administrative Radio Conference which was held in Geneva during 1979. All world nations attended this conference; therefore, it was imperative for the United States to be ready to defend or negotiate its frequency spectrum needs through year 2000. In FY 1980, the ECAC manpower to support its mission was 54 military/ civil service and approximately 600 contractor personnel.

Program Element: #33144F

DOD Mission Area: Other Support Programs, #325

Title: Electromagnetic Compatibility Analysis Center (ECAC)
Budget Activity: Intelligence and Communications, #5

2. (U) FY 1981 Program: Research, Development, Test and Evaluation funding will provide continued data base and Frequency Records Resource System development and the expansion of analytical model capabilities in many areas of electromagnetic compatibility solution. The analysis project efforts will expand as demand by Defense and other government agencies for analysis services continues to increase. The majority of analysis projects, for both Defense and non-Defense activities, are financially supported by those activities through reimbursement.

3. (U) FY 1982 Planned Program: The FY 1982 program will be similar in content to the efforts described above. It is anticipated that as systems become more complex and the number of frequency spectrum users grows, the interference problems and requests for analysis and data will increase. The level of effort expended on work directly funded under this program will be held approximately constant while the amount of user's reimbursed work is expected to grow by about 2%. However, the dollar amount of reimbursements will be slightly less than FY 1981 due to reduced requirements for non-labor items.

4. (U) FY 1983 Planned Program: The FY 1983 plan will be similar in content to FY 1981 activities. The capability development will continue since the sophistication of electronic communications systems will increase. Because of the previous fiscal year increases in requirements and complexity, it is predicted that reimbursed programs will increase at the same rate predicted for FY 1982.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 33401F
DOD Mission Area: COMSEC, #324

Title: Communications Security (COMSEC)
Budget Activity: Intelligence and Communications, #5

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3,050	1,988	1,600	1,400	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The principal objective of this program is the improvement of communications security within the United States Air Force. It is a continuing effort divided into several task areas. The overall effort is part of national communications security program managed by the National Security Agency with participation by other services/agencies. The Air Force portion of this overall program addresses problems encountered in adapting general purpose cryptographic equipment for use in new communication systems. The efforts are primarily directed at insuring that all systems being developed by the Air Force meet current national communications security requirements. Specific emphasis is placed on correcting any known deficiencies.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This level of effort program supports all Air Force communications security Research, Development, Test, and Evaluation. Tasks under this project include support of the development of advanced narrowband digital voice techniques for communications security applications, development of a secure telemetry capability for the national test ranges, the development of new secure communications techniques using fiber optics, and the evaluation of hazards and the means of protecting against the hazards of non-desired radiation. The project supports the Air Force Electronic Security Command in providing compromising emanations testing for all Air Force cryptographic equipment. Cost estimates are based on previous similar program experience and were made by the Air Force Systems Command on October 31, 1980.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
RDT&E	1,100	1,100	1,100			

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: # 33401F

DOD Mission Area: COMSEC, #324

Title: Communications Security (COMSEC)

Budget Activity: Intelligence and Communications, #5

(U) DETAILED BACKGROUND AND DESCRIPTION: This program accomplishes communications security research, development, test and evaluation for improved security in United States Air Force systems. It is a continuing effort divided into security standards and assessments, communications security technology, secure voice, space and weapons security, record and data security and communications security technical support task areas. The overall effort is part of a national communications security program managed by the National Security Agency with participation of all the services and defense agencies. Such an organization fosters exchanges of communications security technology, reduces duplication and insures that national objectives are being satisfied with a high degree of commonality.

(U) RELATED ACTIVITIES: The National Security Agency is the overall manager of communications security equipment research and development under the policy guidance of the Assistant Secretary of Defense (Communications, Command, Control and Intelligence). The services perform efforts under common Program Element #33401. The Air Force Electronic Security Command performs COMSEC testing on off-the-shelf equipment selected for operational use in the USAF and also recommends the use of cryptographic equipment to operational commands.

(U) WORK PERFORMED BY: All research and development tasks under this program are managed through the Rome Air Development Center of the Air Force Systems Command, Electronic Systems Division, Hanscom AFB, MA. Contractors are: Lincoln Laboratories Bedford, MA; National Bureau of Standards, Boulder, CO; Booz-Allen, Bethesda, MD; ARCON, Wakefield, MA; DYNASTAT, Inc., Austin, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This project has supported Air Force research and development of fiber optics communications and has demonstrated the use of fiber optics for both system control and communications security functions. The National Security Agency has tested a secure fiber optics system developed under this program. The Air Force and Navy have a joint program to provide secure telemetry for test ranges at Eglin, Edwards and Kirtland Air Force Bases and the Eastern and Western test ranges. A secure communications controller was tested at the Air Force Data Services Center and is being further developed by the National Security Agency. An automated compromising emanations analysis system to improve the manpower intensive nature of compromising emanations testing was delivered to the Air Force Communications Security Support Center.
2. (U) FY 1981 Program: Fiber optics development will continue with National Security Agency participation in the development of advanced intrusion resistant cables. Work in the voice processing area will emphasize solution of problems in high noise environments and participation in the Narrowband Secure Voice Consortium will continue. Support will continue to the Air Force Communications Security Support Center compromising emanations testing program with continued research into automated techniques and compromising emanations problems. Work will begin to define techniques for signals security analysis and integration of secure voice and electronic counter counter measures. A Ground Radio Interface Device will be developed to permit installation of secure voice systems in fixed ground radio facilities.

Program Element: # 33401F

DOD Mission Area: COMSEC #324

Title: Communications Security (COMSEC)

Budget Activity: Intelligence and Communications #5

3. (U) FY 1982 Planned Program: The program will continue to provide support to the development of equipment for compromising emanations testing and intrusion resistant fiber optics and will support the Department of Defense Narrowband Secure Voice Consortium. A digital voice interoperability program will be pursued to resolve interoperability problems between secure voice systems projected for use throughout the Air Force, the Department of Defense and allied nations. Prototype development of the Ground Radio Interface Device will be completed and a pilot production will be conducted.
4. (U) FY 1983 Planned Program: The Program Office will continue to provide support to the development of equipment for compromising emanations testing and will support the DoD Narrowband Secure Voice Consortium. Investigation of techniques for signals security analysis will continue with a goal of FY 1983 for initial operational capability. Digital Voice Interoperability investigations will continue with emphasis on developing interfaces between systems operating at different data rates.
5. (U) Program to Completion: This is a continuing program with emphasis shifting among efforts as Air Force priorities and resources dictate. Major emphasis will continue on narrowband voice processing requirements and compromising emanations testing equipment with increasing emphasis on signals security.
6. (U) Milestones: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 35114F

Title: Traffic Control and Landing Systems (TRACALS)
DoD Mission Area: Navigation and Position Fixing, #321
Budget Activity: Intelligence & Communications, #5

(U) RESOURCES (PROJECT LISTING): (\$ in thousands) 1/

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	3,058	3,070	5,400	3,400		N/A
1956	TPN-19 Improvements	400	1,370	400			2,406
2026	System Support	200	200	300	300	Continuing	N/A
2148	LORAN C/D	2,270	800	1,700			26,700
2610	Berlin Long Range Radar		500	800	800		2,100
2681	GPN-22 Electronic Counter-Countermeasures	188	200	2,200	1,000		3,588
2760	Mobile Planar Array				600	2,000	2,600
2759	Advanced Military Landing System				700	35,000	35,700

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION: This program provides the Air Force with the Air Traffic Control and Landing equipments required for safe, efficient, worldwide, all weather Air Force flying operations. The mission need is to provide take off, enroute and landing guidance and surveillance in order to meet wartime sortie requirements. In peacetime, the need is to support training, logistics and other operational flying with maximum safety.

BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 request includes funds for completing reliability and maintainability improvements for the AN/TPN-19 mobile landing control central and correcting deficiencies in the tactical Long Range Navigation (LORAN) system (AN/TRN-38). Additionally, funds are requested to develop electronic counter-countermeasures for the precision approach radars in Berlin (Project 2681) and to define requirements in sufficient detail to secure funding from the Federal Republic of Germany for automating the United States-owned and operated air traffic control, centers in Berlin. The Federal Republic of Germany has already provided \$24.6M to replace the United States-owned long range radar in Berlin and has agreed in principle to funding the automation project for an additional \$30.5M. FY 1982 cost estimates for projects 1956, 2148 and 2681 were derived by the Electronic Systems Division from parametric analysis. System support and Berlin Radar expenses are estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Cost
RDT&E Procurement (Other)	4,200	3,100	2,200			N/A
		5,500	13,900		Continuing	N/A

1/ The dollars contained within this Descriptive Summary are correct. However, they are at variance with the R-1 document due to late administrative action.

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Program Element: #35114F

DoD Mission Area: Navigation and Position Fixing, #321

Title: Traffic Control and Landing Systems (TRACALS)

Budget Activity: Intelligence and Communications, #5

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)
Funds from Federal Republic of Germany
for Berlin Radar Project 2610

<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Cost</u>
3,098	4,223 (7,800)	4,337 (21,500)	(13,000)	Continuing (22,800)	N/A (65,100)

Program Element: # 35114F

DoD Mission Area: Navigation and Position Fixing, #321

Title: Traffic Control and Landing Systems (TRACALS)
Budget Activity: Intelligence & Communications, #5

(C) DETAILED BACKGROUND AND DESCRIPTION: The TRACALS program was established to provide single management of the many related programs required to modernize the electronic equipments which comprise the Air Force Traffic Control and Landing System (TRACALS). Maximum use is made of state-of-the-art, off-the-shelf equipments to meet this goal. TRACALS research and development efforts are aimed toward the development of technology and equipment required to satisfy the Air Force's unique, military, worldwide, flying mission. Every effort is made to capitalize on the research and development activities of other federal agencies involved in air traffic control and navigation (primarily the Federal Aviation Administration). This assures standardization within and interoperability with the National Aerospace System. This request represents a transition from a high investment phase of the program which modernized Air Force fixed base air traffic control surveillance and precision radars, procured a new family of Instrument Landing Systems, developed a tactical LORAN system and fielded a new mobile air traffic control radar to a program to reflect the needs of the 1990s. With the exception of activities related to Berlin, FY 1982 research and development is confined to correcting deficiencies and making enhancements to previously developed systems. Reliability, maintainability and communications systems enhancements to the AN/TPN-19 landing control central are tested, procured and installed. Several years of effort to improve the reliability and reduce the life cycle cost of the AN/TRN-38 tactical LORAN system are culminated in FY 1982. Activities in FY 1981 and prior years have identified needed fixes and enhancements, determined technical solutions and costed them. In FY 1982 prototype hardware fixes are delivered, tested, and acquired; a deployment manual acquired; and software to support grid prediction developed. This latter effort produces software resident in the Defense Mapping Agency computer and is in lieu of a previously planned worldwide mobile grid prediction and calibration capability. The change assumes that until the Global Positioning System provides a worldwide capability, it will not be necessary to move the AN/TRN-38 from its planned locations.

The line for an Advanced Military Landing System in FY 1983 represents funds for planning the first stage of a massive program to convert the Air Force's precision landing capability from precision approach radar and the Instrument Landing System to a capability which is interoperable with the International Civil Aviation Organization and Federal Aviation Administration standard Microwave Landing System. A Mission Element Need Statement in accordance with Office of Management and Budget Circular A-109 is being processed by the Office of the Secretary of Defense reflecting the tactical limitations of the Instrument Landing System, the high expense and limited life span of precision approach radars and the need to interoperate with the Microwave Landing System in the future. Assuming civil sector implementation of the Microwave Landing System, plans are to use commercially available and militarized variants of the Microwave Landing System to satisfy the Advanced Military Landing System requirement. The program will be paced by civil sector implementation plans.

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Program Element: # 35114F

DoD Mission Area: Navigation and Position Fixing, #321

Title: Traffic Control and Landing Systems (TRACALS)
Budget Activity: Intelligence & Communications, #5

(U) RELATED ACTIVITIES: This program is related to, and through the mechanism of the Federal Radionavigation Plan, coordinated with the Federal Aviation Administration's plans for the National Airspace System. Key related programs are the Global Positioning System and national plans for the Microwave Landing System. Air Force requirements for Tactical Air Navigation (TACAN) and LORAN are expected to terminate when Global Positioning System equipment is available in nearly all Air Force and NATO aircraft (early 1990's) and funds in this Program Element for TACAN and LORAN are limited to those necessary to retain a capability until the Global Positioning System is fully implemented. National adoption of the Microwave Landing System will require replacement of all Air Force ground and airborne Instrument Landing System equipment. Present plans are to acquire versions of the Microwave Landing System to replace both the Instrument Landing System and the Precision Approach Radar. This will require a \$750 million investment over a 15 year period. Off-the-shelf equipment developed by the Federal Aviation Administration will meet Continental United States fixed base needs. The Army developed Joint Tactical Microwave Landing System will meet needs for operation in forward areas. Versions of the Microwave Landing System will have to be developed to provide survivability and jam resistance in high threat areas and a full capability transportable system will have to be packaged.

(U) WORK PERFORMED BY: The Air Force Electronic Systems Division, Hanscom AFB, MA; is responsible for the management of the projects included under this program. Contractors are: Raytheon, Waltham, MA; Sperry Gyroscope Division, Sperry Rand Corp, Great Neck, NY; ARINC Research Corp, Annapolis, MD; Texas Instruments Inc, Dallas, TX; General Electric Company, Syracuse, NY.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Requirements for replacing the Berlin Long Range Radar and modernizing operations centers were defined, funds were obtained from the Federal Republic of Germany under terms of the occupation agreement and the General Electric AN/FPS-117 radar was selected because of its superior logistics supportability and performance. Delivery began on the two tactical LORAN systems for Europe. Of the original 72 test deficiencies identified for the tactical LORAN system only eight were not corrected or on contract at the end of FY 1980. Solutions have been identified for these eight and requested FY 1982 funds will correct them. Communications system improvements for the AN/TPN-19 Landing Control Central were designed and fabricated and design studies were initiated for the remaining directed improvements. The AN/TRN-41 lightweight airdroppable TACAN began entering the inventory to serve Military Airlift Command airdrop and Communications Command navigational aid survivability needs. Studies were performed resulting in an approach to assure precision approach radar service in Berlin in the event of Warsaw Pact jamming.

2. FY 1981 Program: Electronic counter-countermeasures for the Berlin Long Range Radar will be developed

Previously contracted corrections to the tactical LORAN system will be delivered and tested, and design efforts completed on the remaining eight items. AN/TPN-19 communications system enhancements will be tested and a production decision made. System performance software improvements will be developed and tested, and more reliable search radar transmitters acquired.

Program Element: # 35114F

DoD Mission Area: Navigation and Position Fixing #321

Title: Traffic Control and Landing Systems (TRACALS)
Budget Activity: Intelligence & Communications #5

3. FY 1982 Planned Program: The Berlin Long Range Radar replacement will be tested, delivered and installed. Assuming funds from the Federal Republic of Germany are forthcoming, contracts will be let leading to automation of the air traffic control. of the tactical LORAN system will be corrected, tested and the system deployment completed. A grid prediction system to enhance system accuracy Defense Mapping Agency for use with their data base and computers. A contract will be let to develop and test electronic counter-countermeasures for the Berlin precision approach radars. Deviations from the FY 1981 submission are discussed in the last paragraph.

4. (U) FY 1983 Planned Program: Assuming German funding is received, full scale development of automated operations centers in Berlin will commence leading to an FY 1986 operational activation. Electronic counter-countermeasures for the Berlin precision approach radars will be delivered, tested and a production decision made for an FY 1984 acquisition. Work will commence to develop a solution to false target radar beacon system returns experienced by the AN/TPX-42 interrogators in mobile radar systems. Planning will commence on an implementation strategy for acquiring an Advanced Military Landing System to overcome the high expense and operational limitations of the precision approach radar and the lack of mobility of the Instrument Landing System. Plans are to comply with previous guidance and use versions of the Federal Aviation Administration developed Microwave Landing System to satisfy Air Force requirements. This will be a \$750 million effort over 15 years. The Office of the Secretary of Defense is presently processing a Mission Element Need Statement for this requirement.

5. (U) Program to Completion: This is a continuing program. Requirements are being defined for a replacement for the 1950's vintage AN/MPN-14 radar control centrals, for survivability of fixed air traffic control radars in high threat areas, for removing systems supplanted by the Global Positioning System, and to adjust to Federal Aviation Administration initiatives such as the Discrete Address Beacon System and the Beacon Collision Avoidance System. At a minimum, the advent of the Microwave Landing System, the age of all but the AN/TPN-19 mobile air traffic control radars and the vulnerability of fixed base air traffic control radars will generate another period of high investment for this program.

6. (U) Milestones: Not Applicable

7. (U) Resources: Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
RD&E	4,200	3,100	2,200			
Procurement (Other)		5,500	13,900			
					Continuing	N/A
					Continuing	N/A

Program Element: # 35114F

DoD Mission Area: Navigation and Position Fixing, #321

Title: Traffic Control and Landing Systems (TRACALS)

Budget Activity: Intelligence & Communications, #5

The FY 1982 procurement funds related to RDT&E projects are reduced from the FY 1981 estimate to account for receipt of funding from the Federal Republic of Germany to replace the Berlin Long Range Radar (Project 2610). FY 1982 RDT&E funds for the AN/TPN-19 mobile landing control central enhancements are increased by \$300 thousand though total RDT&E expense for the project is reduced as it was not necessary to spend all FY 1980 funds. Funds for the tactical LORAN system increase over the FY 1981 submission as a result of work done in FY 1980 to define and cost solutions to remaining deficiencies. The funding profile for Electronic counter-countermeasures development for the AN/GPN-22 has been slipped one year and increased by \$1.3M to reflect the results of feasibility studies conducted in FY 1980.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63101F

DOD Mission Area: Technical Integration/Studies
and Analysis, #440

Title Development Planning
Budget Activity Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	1,100	0	3,300	3,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: PE 63101F provides for preliminary design and assessment of technical concepts which will support mission area analyses, preparation of mission element need statements, and architecture of multi-system capabilities and options needed for pre-Milestone "O" period preceding acquisition. These development planning efforts, both in-house and contract, enhance future Air Force capabilities through improved, timely planning. Air Force Systems Command (AFSC) will ensure through application of Vanguard planning, and Air Force guidance that efforts are directed toward solving the needs of the major Commands. With the planning conducted under this program element, millions of dollars are saved because new ideas are either validated or are cancelled before they become expensive programs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Includes funds to provide the initial planning for resolution of problems identified during mission area analyses. The costs were estimated using historical data and are based on addressing 19 of the 50 problem areas identified during Vanguard planning.

(U) COMPARISON FOR FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	1,100	2,000	4,100		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: # 63101F

DOD Mission Area: Technical Integration/Studies
and Analysis, #440

Title: Development Planning

Budget Activity: Defense-wide Mission
Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element or its equivalent has been in existence for over 20 years as the primary source of independent analytical and conceptual thinking in Air Force development planning. The primary effort, concept development and analysis/system design, consists of analyses and investigations that are required prior to the development of weapons systems. The program objectives are to: (a) Identify existing and future Air Force needs and deficiencies; (b) Define alternative conceptual systems in response to identified deficiencies; (c) Evaluate economical and technical feasibility of future concepts; (d) Analyze effectiveness of future concepts and compare with systems already in existence; (e) Perform preliminary design analyses. These efforts are a part of the continuing examination of the Air Force mission areas and of the suitability and applicability of technology developments to Air Force needs. The results of these efforts are applied to current and proposed technology programs and help establish and clarify future Air Force system requirements.

(U) RELATED ACTIVITIES: The efforts performed under this program provide part of the information base needed to move a program/concept from the pre-Milestone "O" stage of the weapon system acquisition process through the Milestone I decision. At any point during the first two phases, efforts are transferred out of this program element into new or existing program elements. Previous efforts under this program have led to further identification of requirements in programs like: (1) PE 63421F, Global Positioning System; (2) Satellite Inspection System; (3) Escape From Spacecraft; (4) Advanced Cargo Tanker; (5) PE 64314F, Advanced Medium Range Air-To-Air Missile; (6) PE 64607F, Wide Area Antiarmor Munition; (7) PE 64725F, Aircraft Identification (NATO); (8) C-5A (From C-X); (9) F-16, F-17 (From light weight fighter); (10) PE 64754F, Joint Tactical Information Distribution System; (11) PE 64201F, Aircraft Avionics.

(U) WORK PERFORMED BY: The primary effort is performed by Air Force Systems Command (AFSC) and its Product Divisions and Centers. Through Air Force Systems Command (AFSC), assistance is also provided to other Air Force commands. Efforts by the Air Force planning organizations will be supplemented by contracts with aerospace, missile, and electronic industries; institutes; and research laboratories such as: The Boeing Company, Seattle, WA; Rockwell International Corporation, Columbus, OH; Hughes Aircraft Company, Conoga Park, CA; General Dynamics, Pomona, CA; Draper Laboratory, Boston, MA; Martin Marietta, Orlando, FL; General Research Corporation, Santa Barbara, CA; Farnsworth Cannon Inc., McLean VA; Consolidated Analysis Centers Inc., Arlington, VA; General Dynamics, Fort Worth, TX; McDonald-Douglas Aircraft Company, St Louis, MO; Analytic Sciences Corporation, Reading, PA; and, Arinc, Annapolis, MD.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The following are some representative past study efforts: (a) Investigated revolutionary, as opposed to evolutionary systems, to detect and/or negate cruise missiles; (b) Assessed the least cost warfare concept to provide an insight into the marginal and absolute utility of systems from an economic perspective; (c) Investigated the ability of selected electromagnetic systems to perform in the wartime electromagnetic environment. Friendly, neutral, and civilian as well as enemy jamming emissions were considered; (d) The Airfield Attack Munitions effort considered the optimum munitions or combinations of munitions required to perform the airfield attack mission in the near, interim, and far term. Both domestic and foreign systems were evaluated; (e) A Laser Hellfire Missile Evaluation program

Program Element: #63101F

DOD Mission Area: Technical Integration/Studies
and Analysis, #440

Title: Development Planning

Budget Activity: Defense-wide Mission
Support, #6

to assess the feasibility of employing Laser Hellfire on the A-10 aircraft; (f) Definition and evaluation of methods to counter jammer threats to GBU-15 data links; (g) An evaluation of existing, developmental, or planned technologies for potential application to Anti-Radiation Missile (ARM) protection systems; (h) An Advanced Conventional Standoff Missile evaluation to examine the utility of employing standoff missiles with conventional warheads in the European and anti-ship roles; (i) Defense Suppression Integration Analysis for the integrated development of defense suppression concepts, technical alternatives, and resource mix recommendations; (j) The definition of Communication/Navigation Requirements needed to improve tactical weapon system effectiveness; (k) A Non-Nuclear Armament Plan to establish a guide to formulate program planning direction on United States Air Force (USAF) nonnuclear munitions development; (l) Wide Area Anti-Armor Munition (WAAM) program to provide, at the earliest possible time, a Conventional Ordnance Tactical Force effectiveness multiplier for use against the armor threat; and, (m) Tactical Forward Area Air Surveillance and Control Internettting evaluation to determine the functional and data processing requirements for automating certain elements such as radar tracking, track correlation, and message processing, related to future tactical forward area surveillance concepts.

2. (U) FY 1981 Program: FY 1981 program was reduced to zero from the program submitted because of Congressional reduction in funds.

3. (U) FY 1982 Planned Program: Mission area analyses recently completed, those currently under way, and new efforts will be the source for new concepts of operational systems and equipment. The specific initiatives for the FY 1982 program will be proposed and evaluated during FY 1981. HQ AFSC and Air Staff guidance will ensure that efforts are directed toward identified Air Force mission needs. Mission area analysis indicates that some of the significant areas needing planning are: concepts of offensive space operations, prioritized stand-off weapon options, tactical airlift modernization, and correlation/fusion architectures. The FY 1982 program was reduced in scope by OSD.

4. (U) FY 1983 Planned Program: The specific investigations for the FY 1983 program will be proposed and evaluated during FY 1982. HQ AFSC and Air Staff guidance will ensure that efforts are directed toward identified Air Force mission needs. Mission area analysis results indicate that some of the broad areas that will require more specific pre-Milestone "O" planning in the FY 1983 time frame are: Identification Friend or Foe (IFF) system analysis for beyond-visual-range missiles, aerial refueling requirements, and lethal C3 jammer weaponization. The FY 1983 program was reduced in scope by OSD.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63226F

DoD Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: DoD Common Language
Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		0	0	7,000	TBD	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program is part of the total DoD effort to implement, introduce, and provide life-cycle support for Ada, the DoD common, high-order programming language for embedded computers. It will provide resources to meet those language support requirements which are common to the services and agencies. It will provide for development of an Ada Programming Support Environment (APSE) and development of the supporting culture, including management and technical discipline, to assure the DoD a consistent, integrated programming system which will enhance software portability and afford maximum availability of common tools needed to develop and support defense systems software.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Ada Program was supported during FY 1977-81 with funds from the Military Departments, and to a lesser extent from the Defense Advanced Research Projects Agency (DARPA) and the Defense Communications Agency (DCA). These funds have provided for both common and service specific needs. In FY 82 and subsequent years, funding for the common needs of the Ada Program will be provided by this program element. The Military Departments and Agencies will continue to support their Department/Agency specific needs. Each component will have responsibility for funding its respective needs. The Air Force will serve as executive agent for funding the Ada Program requirements through this program element. OUSDR&E(E&PS) has oversight authority for this and other program elements in the Military Departments involving Ada related activities. The Ada language was published in July 1980 and various standardization activities are under way. An Ada Compiler Validation Capability is under development, and an initial version will be available in October 1981.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63226F

Program Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: DoD Common Language

Budget Activity: Defense-Wide Mission Support, #6

- (U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: DoD computer software life-cycle costs are measured in the billions of dollars. Inflation and increased applications of computers to new functions threaten to make software an even more substantial portion of the DoD budget. The DoD recognizes that use of a common, high order language and a modern programming support environment coupled with modern programming practice will provide the leverage to control the cost and improve the reliability of software. In 1975 the Director, Defense Research and Engineering (DDR&E), established the High Order Language Working Group (HOLWG), with representation from Army, Navy, Air Force, Defense Communications Agency (DCA), National Security Agency (NSA), and Defense Advanced Research Projects Agency (DARPA), to investigate the feasibility of adopting a common, high order computer language for use on embedded computer systems. A comprehensive set of language requirements was developed through extensive coordination in DoD, allied countries, industry and academia. Existing computer languages were formally evaluated against these requirements. No existing language was sufficiently powerful to serve as the common language. The HOLWG undertook a competitive international procurement for the design of a language to meet those requirements. Funds for this activity were provided by the Military Departments and program management was provided by DARPA. The language design was completed in May 1979. Extensive testing and public exposure followed, leading to some refinements and a final definition of the language in July 1980. Development of a complete Ada Programming Support Environment will provide for the full potential of Ada.
- (U) RELATED ACTIVITIES: The Ada Program is managed by the Ada Joint Program Office (AJPO) through coordination with the components. In general, the AJPO is responsible for the common Ada-related needs of the DoD and the components are responsible for component-specific needs. Rehosting/retargeting of Ada Programming Support Environment software is the responsibility of the components. Each component has developed an introduction strategy and is responsible for implementation of that strategy.
- (U) WORK PERFORMED BY: The Ada Joint Program Office is responsible for all work performed under this program element. Specific efforts will be conducted by Air Force, Army and Navy organizations as appropriate. Major contractors are Honeywell, Minneapolis, MN; ALSYS, Versailles, France; Softech, Boston, MA; Intermetrics, Boston, MA; Computer Science Corp, Falls Church, VA; Texas Instruments, Dallas, TX.

Program Element: #63226F

DoD Mission Area: Electronic and Physical Sciences
(ATD), #551

Title: DoD Common Language

Budget Activity: Defense-Wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

- (U) 1. FY 1980 and Prior Accomplishments: Requirements for a common DoD language for embedded computers were developed and used as the basis for a procurement in which competitive designs were evaluated and a single language chosen. Test and Evaluation was completed. Development of an Ada Compiler Validation Capability was initiated. A requirements definition for an Ada Programming Support Environment was completed.
- (U) 2. FY 1981 Program: Refinement of the language continues in response to language standardization activities. Ada was designated Military Standard 1815 in December 1980. American National Standards Institute (ANSI) procedures have been initiated to establish Ada as a national standard. An effort is under way to provide a Formal Semantic Definition of Ada which is mathematically precise. Competitive designs are in progress for Ada Programming Support Environments. Development of the Ada Compiler Validation Capability continues.
- (U) 3. FY 1982 Program: Definition of the Formal Semantics of Ada will continue. ANSI standardization activities will be completed. NATO and International Standards Organization (ISO) procedures will be initiated. The initial Ada Compiler Validation Capability will be operated by a Compiler Validation Office. Development of more advanced compiler validation facilities and performance benchmarks will be initiated. Development of Ada Programming Support Environments will continue. Conventions will be defined for interfaces between tools, users and data bases. Complete standard library and applications library requirements will be defined and implementations initiated. Conventions for reusable Ada software components will be developed. Style and documentation standards will be defined. A software methodology based on Ada will be defined and specific tool developments to support that methodology will be initiated. Ada Training and automated support facilities will be developed.
- (U) 4. FY 1983 Program: The Formal Semantic Definition will be completed. Standardization activities will continue. The Ada Compiler Validation Capability will be completed. Development of libraries will continue. The initial Ada Programming Support Environment will be available. Projects will begin to use Ada. Development of software support tools will continue. Programmers will be trained in the use of Ada and the programming support software.
- (U) 5. Program to Completion: This is a continuing program.
- (U) 6. Milestones: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63401F

Title Space Vehicle Subsystems

DOD Mission Area: Space Launch and Orbital Control, #410

Budget Activity Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
681D	Advanced Space Guidance Technology	9,500	9,900	0	0	Continuing	Not Applicable
682J	Advanced Space Power Supply Technology	2,823	4,200	0	0	Continuing	Not Applicable
688F	Advanced Satellite Secondary Propulsion Technology	1,650	1,500	0	0	Continuing	Not Applicable
2181	Advanced Space Computer Technology	109	200	0	0	Continuing	Not Applicable
		4,918	4,000	0	0	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This applied, advanced technology program is to define, develop, and demonstrate new/improved space vehicle subsystem concepts/prototypes which are applicable to numerous space programs and are essential for meeting DOD space mission needs in the 1980s and 1990s. The primary objective of this program is to increase satellite survivability, autonomy, performance, reliability, and lifetime. A secondary objective is to accomplish the prime objective with lighter, less complex, and more economical subsystems than currently exist. Development efforts are in guidance, power supply, secondary propulsion, and computer subsystems.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The program was deferred due to higher Air Force funding priorities.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
RDT&E	9,500	12,200	13,700		Continuing	Not Applicable
PROCUREMENT						
						Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63401F

DOD Mission Area: Space Launch and Orbital Control, #410 Title Space Vehicle Subsystems
Budget Activity Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT								
681D	Advanced Space Guidance Technology	9,500	9,900	0	0	0	Continuing	Not Applicable
682J	Advanced Space Power Supply Technology	2,823	4,200	0	0	0	Continuing	Not Applicable
688F	Advanced Satellite Secondary Propulsion Technology	1,650	1,500	0	0	0	Continuing	Not Applicable
2181	Advanced Space Computer Technology	109	200	0	0	0	Continuing	Not Applicable
		4,918	4,000	0	0	0	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This applied, advanced technology program is to define, develop, and demonstrate new/improved space vehicle subsystem concepts/prototypes which are applicable to numerous space programs and are essential for meeting DOD space mission needs in the 1980s and 1990s. The primary objective of this program is to increase satellite survivability, autonomy, performance, reliability, and lifetime. A secondary objective is to accomplish the prime objective with lighter, less complex, and more economical subsystems than currently exist. Development efforts are in guidance, power supply, secondary propulsion, and computer subsystems.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The program was deferred due to higher Air Force funding priorities.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	9,500	12,200	13,700		Continuing	Not Applicable
PROCUREMENT						
						Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

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Program Element: #63401F

DOD Mission Area: Space Launch and Orbital Control, #410

Title: Space Vehicle Subsystems

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This is the Department of Defense's (DOD) only applied, advanced technology program for defining, developing, and demonstrating spacecraft subsystem concepts/prototypes applicable to multi-users and essential for meeting DOD space mission needs in the 1980s and 1990s. The guidance, power supply, secondary propulsion, and computer subsystems being developed by this program are the spacecraft support systems for the mission payload. Future payloads need: more precise orientation, greater survivability against natural and man-made threats, and ability for more autonomous operation. There are four projects within the Space Vehicle Subsystems program to meet these needs. Project 681D (Advanced Space Guidance Technology) defines, develops, and demonstrates space guidance, navigation, and control subsystems and components which (1) provide autonomous, non-radiating guidance systems and (2) improve inertial attitude reference accuracies. Project 682J (Advanced Space Power Supply Technology) defines, develops, and demonstrates power subsystems (e.g., batteries, solar panels, and power management systems) to (1) increase nuclear, laser, and natural environmental survivability, (2) increase power output and lifetime, and (3) substantially reduce volume and weight. Project 688F (Advanced Satellite Secondary Propulsion Technology) defines, develops, and demonstrates new/improved propulsion concepts to (1) increase satellite life, (2) improve attitude control precision, and (3) reduce secondary propulsion system weight. Project 2181 (Advanced Space Computer Technology) defines, develops, and demonstrates selected computer, memory storage, data preprocessor, and software subsystems and components to (1) increase reliability and mission life, (2) decrease satellite ground terminal down-link requirements, (3) provide radiation hardening, (4) increase memory access capability, and (5) reduce weight, volume, and power requirements.

(U) RELATED ACTIVITIES: The following relationships exist with other activities. Project 681D (Advanced Space Guidance Technology) receives inputs from Program Element (PE) #62204F (Aerospace Avionics). Project 682J (Advanced Space Power Supply Technology) receives power system technology inputs from PE #62203F (Aerospace Propulsion), Project 688F (Advanced Satellite Secondary Propulsion Technology) receives secondary propulsion technology inputs from PE #62302F (Rocket Propulsion). Project 2181 (Advanced Space Computer Technology) provides funding for space-related efforts associated with PE #63203F (Advanced Avionics for Aircraft), conducts a joint satellite self-test and self-repair computer development with PE #63431F (Advanced Space Communications), conducts a joint program with PE #62102F (Materials) for the Solid-State Mass Memory effort, and provides technical assistance to Rome Air Development Center in the investigation of an On-Board Signal Processor with PE #62702F (Command, Control, and Communications) and PE #62301E, a Defense Advanced Research Projects Agency program element. Also, the Space Vehicle Subsystems program is performing a joint spacecraft autonomy study with PE #63438F (Satellite Systems Survivability) and flies its payloads via PE #63402F (Space Test Program).

(U) WORK PERFORMED BY: Air Force Space Division, Los Angeles, CA manages the program and executes Projects 681D and 2181. Project 682J is executed by the Air Force Aero-Propulsion Laboratory, Wright Patterson AFB, OH and Project 2181 is executed by the Air Force Rocket Propulsion Laboratory, Edwards AFB, CA. Principal contractors are: Project 681D--Martin Marietta Corp, Denver, CO (Space Sextant) and TRW, Redondo Beach, CA (Multi-mission Attitude Determination and Autonomous Navigation System); Project 682J--Hughes Aircraft Co, El Segundo, CA (Nickel-Hydrogen Battery and High Efficiency Solar Panel); Project 688F--Fairchild Aerospace, Long Island, NY (Pulsed Plasma Thruster); and Project 2181--Raytheon Co, Sudbury, MA and Questron Corp, San Diego, CA (Fault Tolerant Spaceborne Computer) and Texas Instruments, Dallas, TX (Solid-State Mass Memory).

Program Element: #63401P

DOD Mission Area: Space Launch and Orbital Control, #410

Title: Space Vehicle Subsystems

Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: There have been many major accomplishments in this program, particularly in the power supply area. Nickel-hydrogen batteries have been developed and flight tested. This technology has resulted in a factor of four improvement in the amount of electrical energy storage per pound for geosynchronous missions. For low earth orbit missions, the improvement is even greater and the recharge characteristics superb. The high performance capabilities of these nickel-hydrogen batteries have resulted in the selection of them for use in the Satellite Data System satellites. Earlier, the Space Vehicle Subsystems program developed and demonstrated an advanced nickel-cadmium battery which nearly doubled energy storage per pound at geosynchronous orbit. The Fleet Satellite Communications satellites use this technology. In the solar cell area, high efficiency gallium-arsenide cells have been developed and flight tested which are hardened and should result in about a one-third reduction in solar panel sizes. An earlier solar cell development demonstrated how to obtain higher efficiencies from silicon cells than conventionally obtained. This advanced silicon cell technology is being used for the solar panels in the Defense Satellite Communications System satellites. Both the solar cell and battery technologies developed lead to longer life systems. Other subsystems that have completed development within this program include the Flexible Rolled-Up Solar Array--baselined for the NASA Large Space telescope and Multi-mission Modular Spacecraft, frictionless Momentum Wheel, Space Precision Attitude Reference System, Ultraviolet Radiometer, Velocity Vector Sensor Assembly, and the Optical Angular Motion Sensor.

(U) In FY 1980, the following activities took place: Project 681D (Advanced Space Guidance Technology)--the ground demonstration was successfully completed of the frictionless (magnetic bearing) Momentum Wheel which has a long lifetime and significant reliability and performance characteristics, payload reconfiguration was initiated for space test of the Space Sextant Attitude Reference and Navigation System, and the fabrication of the basic sensor chip of the Multimission Attitude Determination and Autonomous Navigation system was started; Project 682J (Advanced Space Power Supply Technology)--the fabrication of a hardened gallium-arsenide High Efficiency Solar Panel continued as did the long life test of the nickel-hydrogen batteries; Project 688F (Advanced Satellite Secondary Propulsion Technology)--the extended life test of the monopropellant thruster was successfully completed; and Project 2181 (Advanced Space Computer Technology)--for the Fault Tolerant Spaceborne Computer, the error correcting software was validated, the radiation hardened Large Scale Integration (LSI) test chip was evaluated, and four of eighteen LSI chips being developed were designed and three fabricated; for the Solid-State Mass Memory, the development was started on a high density bubble chip (four megabits) of a type needed for building a Solid-State Mass Memory which could replace mechanical tape recorders.

2. (U) FY 1981 Program: Under Project 681D (Advanced Space Guidance Technology), the Space Sextant will continue to be integrated and tested on a host structure for flight by the Space Test Program in 1982. The Space Sextant is a gimballed, highly precise autonomous navigation and attitude reference system. It is a non-radiating, anti-jam system which does not require ground station updates, thus enhancing satellite survivability. The other activity in this project is the development of the Multi-mission Attitude Determination and Autonomous Navigation (MADAN) system. Only the basic sensor chip of the MADAN system can be developed. The MADAN system is a nonmechanical long lifetime advanced version of the Space Sextant and uses charged-coupled device detectors. The Project 682J (Advanced Space Power Supply Technology) activity for fabrication and test of a nuclear and radiation hardened gallium-arsenide High Efficiency Solar

Program Element: #63401P

DOD Mission Area: Space Launch and Orbital Control, #410

Title: Space Vehicle Subsystems

Budget Activity: Defense-wide Mission Support, #6

Panel will be truncated. Also, the project activity for continuing the long-life test of nickel-hydrogen batteries will be cut short by a few years. Under Project 2181 (Advanced Space Computer Technology), the fabrication will be deferred of both the Fault Tolerant Spaceborne Computer ground prototype unit and the 4-megabit bubble memory chip for a Solid-State Mass Memory. The Fault Tolerant Spaceborne Computer was to be an ultrareliable long-life general purpose self-test computer which repairs itself. It was to be radiation hardened and have a 95 percent probability of operating at least five years. The Solid-State Mass Memory would have a gigabit nonvolatile memory and could replace mechanical type recorders. Because of program deferral in FY 1982 and FY 1983, two new efforts planned for contract award in 1982 will no longer be started; these efforts are the development of a multi-cell nickel-hydrogen battery in a Common Pressure Vessel to further improve the amount of energy storage per pound and the development of the first High Voltage Power System for spacecraft. Without a high voltage system for spacecraft demanding high power, the weight penalty for using a low voltage system will be large.

(U) The reduction in the FY 1981 program funds compared with those projected in the FY 1981 Descriptive Summary is a result of Air Force priorities.

3. (U) FY 1982 Planned Program: The program was deferred due to higher Air Force funding priorities.
4. (U) FY 1983 Planned Program: The program was deferred due to higher Air Force funding priorities.
5. (U) Program to Completion: This program was deferred.
6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT							
2617	Spacecraft Missions	20,900	21,800	14,900	14,000	Continuing	Not Applicable
2618	Secondary Missions	1,600	1,480	800	700	Continuing	Not Applicable
2619	Shuttle Experiment Support Equipment	4,900	12,900	24,700	38,100	Continuing	Not Applicable
2620	Shuttle Sortie Missions	2,045	4,900	7,300	12,700	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Space Test Program (STP) advances DOD space technology by providing spaceflight missions for demonstrating new system designs and concepts and for determining environmental effects on military systems. This tri-Service program provides the only substantial spaceflight capability to perform fly-before-buy demonstrations of advanced technology designs. The STP is to be the pathfinder for exploiting the Shuttle as a manned space laboratory which should expedite the infusion of new technology into space systems through the use of simpler, incrementally-designed, man-aided systems. The experience gained from this approach will be a key element in fully defining man's military role in space.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for the following: Initiation of total system checkout of Teal Ruby Spacecraft after payload integration is completed; prelaunch checkout and subsequent orbital support for space environmental experiment being flown on host vehicle; payload integration, testing, and subsequent orbital support for DOD's first Shuttle mission, a sortie mission scheduled for flight on the fourth Orbital Flight Test; documentation of lessons learned from this mission for use by future DOD users; procurement of additional Shuttle sortie hardware and modification, as appropriate, to existing sortie hardware to obtain a full complement of reusable hardware; and start of design activities for the next Shuttle sortie mission. The programmed funds are based primarily on contracted amounts and contractor cost estimates for work involved.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
Procurement - Not Applicable	34,400	53,900	77,500		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Our national security depends on the possession of space systems which are the product of a superior technology base. The role of the Space Test Program (STP) is to keep the United States at the forefront of space technology by providing the means to fully exploit the military potential of space through a broad based on-orbit research and test capability. The STP is a tri-Service activity which provides spaceflight missions for conducting feasibility demonstrations of advanced concepts and designs which will contribute to new and improved space systems. The program simplifies the experimenter's job by centralizing management for the many tasks that are required to launch a payload: spacecraft and/or Shuttle experiment support hardware acquisition, payload integration, launch scheduling, support services, and secondary payload space arrangement on other DOD and National Aeronautics and Space Administration (NASA) spaceflights. The STP spacecraft and Shuttle sortie missions are designed around major experiments. Additional secondary experiments are then added as the launch configuration permits. Also, flight opportunities are sought for small secondary experiments on other DOD and NASA spaceflights, but the time to respond to such opportunities is often too short for programming in advance. This program was designated by DOD to be the pathfinder in exploiting the Shuttle as a manned space laboratory for DOD experiments. This approach should expedite the infusion of new technology into space systems through the use of simpler, incrementally-designed experiments aided by man. Brassboard models can then be used on the Shuttle laboratory for testing critical system technologies years in advance of their flight on complex spacecrafts. Such spacecraft are inherently more complex since mission success is dependent upon multioption engineering approaches to compensate for limited space experience. Early test results can then lead to simpler engineering model follow-on Shuttle laboratory tests. Hence, incremental testing enables the pursuit of promising technologies with reduced system complexity. Furthermore, mission success is enhanced because payloads can be returned for reflight as needed, and by proper design of experiments to incorporate a mission/payload specialist, practical workload opportunities increase. The experience gained from this approach will be a key element in fully defining man's military role in space. STP will serve as the transition link to effective manned control and interaction of payloads, on-orbit checkout, and on-orbit repairs. The program is tri-Service documented (AFM 80-2/AR 70-43/OPNAV 76P-2) and was reoriented for the Space Shuttle era by a new DOD policy. The Air Force is DOD's executive agent for this program. The STP program element is comprised of four projects. Project 2617 (Spacecraft Missions) supports experiments which require flight on STP-developed spacecraft. Project 2618 (Secondary Missions) supports the spaceflight of small payloads flown on a pallet, Shuttle structure, low cost free-flyer, or host spacecraft using space on other DOD and NASA spaceflights. Project 2619 (Shuttle Experiment Support Equipment) is for the procurement of equipment and corresponding flight safety analyses to enable use of the Shuttle as a manned laboratory to support experimentation. Project 2620 (Shuttle Sortie Missions) supports the spaceflight of Shuttle sortie missions, initially defined as those in which the main experiment equipment remains in the Shuttle bay and is operated either by automatic control or by a mission/payload specialist during the short time the Shuttle is on orbit.

(U) RELATED ACTIVITIES: Atlas-F vehicles and their corresponding launch support is provided by Space Boosters, Program Element (PE) #35119F. Shuttle launch support and Inertial Upper Stage (IUS) systems are provided by Space Launch Support, PE #35171F. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency, PE #62301E, PE #62711E, and PE #62701E; National Aeronautics and Space Administration; Atmospheric Sciences, PE #61120F; Geophysics, PE #62101F; Materials, PE #62102F; Aerospace Propulsion, PE #62203F; Advanced Weapons, PE #62601F; Space Surveillance Technology, PE #63428F;

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Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

Satellite Systems Survivability, Program Element (PE) #63438F; Space Vehicle Subsystems, PE #63401F; Systems Survivability PE #64711F; and Advanced Space Communications, PE #63431F.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA, is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the Space Test Program (STP). Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. Current payload integration and/or spacecraft contractors are Rockwell International, Seal Beach, CA, and Lockheed Missiles and Space Company, Sunnyvale, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: There have been 33 launches since the first one in 1967: 15 primary and 18 secondary. The primary missions were launched by the STP using three Thor, eight Atlas, two Titan IIIC, one Delta, and one Scout launch vehicles. The secondary missions used space on other DOD and National Aeronautics and Space Administration flights. Ninety-nine payloads have been successfully launched to date. The most recent missions flown were successfully launched in 1979--two primary and one secondary. The primary missions launched were Spacecraft Charging at High Altitudes (SCATHA) and Gamma Ray Spectrometer. Other significant past STP missions include the following: Lincoln Laboratory's Experimental Satellite (LES 6) demonstrated feasibility of Ultra High Frequency (UHF) space communications; LES 8/9 proved new concepts to increase the survivability of future space communication systems;

Timation III was successful forerunner of prototype of the Global Positioning System (GPS):

The following project activities were done in FY 1980. One Project 2617 (Spacecraft Missions) activity was the completion of the Teal Ruby spacecraft structure and fabrication of many of its modules. Another activity was to provide orbital and data reduction support for SCATHA and Gamma Ray Spectrometer missions. Project 2618 (Secondary Missions) provided orbital and data reduction support for a previously launched Host Vehicle Pallet mission. The project also provided for payload integration of two Navy experiments on a host vehicle pallet and for the mission design for flight of an environmental payload on a Defense Meteorological Satellite Program spacecraft. One Project 2619 (Shuttle Experiment Support Equipment) activity was the Request for Proposals completion for Shuttle sortie hardware, its subsequent release, and start of proposal evaluation. Another project activity was the documentation defining lessons learned under Program for use by all future DOD Shuttle users. Under Project 2620 (Shuttle Sortie Missions), design and hardware modifications were made for flight of the Space Sextant experiment as a secondary mission on host Program

The Space Sextant was previously scheduled for flight in 1981 on the Satellite Infrared Experiment (SIRE) spacecraft. This satellite was cancelled in 1979 and the SIRE experiment was restructured to a Shuttle sortie mission. Now that Program was also recently cancelled, the Space Sextant experiment will be flown as one of the experiments on the first Space Test Program (STP) Shuttle sortie mission. Since the same sortie hardware will be used, no setback has occurred. The Space Sextant is a gimbaled, highly-precise autonomous navigational and attitude reference system. Other project activities done were to examine how various Space Test Program experiments could best exploit man and to determine the training that would be required for his use.

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

2. FY 1981 Program: During FY 81, the following activities are planned. Project 2617 (Spacecraft Missions) activities are to integrate and independently test most of the major modules on the Teal Ruby spacecraft structure and to continue to provide data reduction support for SCATHA and Gamma Ray Spectrometer missions. One of the Project 2618 (Secondary Missions) activities is to provide for prelaunch checkout followed by orbital support of the Host Vehicle Pallet (HVP) mission being launched on a classified host vehicle. Of the two Navy experiments being flown on this mission, one is to study solar flare energy conversion and acceleration mechanisms from solar particle isotopes; the other is to assess the potential of stimulated wave-particle interactions as a means to affect communication systems through control of precipitation from radiation belts. Another project activity is to perform payload integration and begin testing of an Air Force space environmental experiment that will be flown on a Defense Meteorological Satellite Program spacecraft. Still another activity is providing data reduction support for a previous HVP mission. Project 2619 (Shuttle Experiment Support Equipment) is capitalizing on the reusable Shuttle sortie support hardware begun under the cancelled Program. This hardware development will be continued under and for STP. The use of the hardware enables support of an important, early DOD Shuttle sortie mission not possible otherwise. Although the hardware is limited in capability, it is considered an early version of that needed for Shuttle exploitation with noncomplex, minimally man-aided experiments. Another project activity is to provide documentation for use by all DOD Shuttle users. The documentation covers common integration procedures for sortie payloads with the Space Transportation System, launch procedures, and methods of training and operation. Under Project 2620 (Shuttle Sortie Missions), the design and mission planning efforts are being performed for flight of the first DOD Shuttle mission which will use the STP hardware being developed under STP Project 2619. The use of man is being examined for this mission.

(U) The reduction in FY 1980 program funds compared with those projected in the FY 1981 Descriptive Summary is a result of not being ready to award the contract for sortie support hardware in FY 1980. The funds were reprogrammed by the Air Force into other high priority Air Force programs. After a thorough assessment was made of the development status of candidate Sortie Support System equipment, the decision was made to slip the contract award date to allow time to reflect a longer, more realistic procurement schedule in the Request for Proposal.

3. FY 1982 Planned Program: These project activities are planned. The Project 2617 (Spacecraft Missions) effort is to initiate the total system checkout of the Teal Ruby spacecraft after payload integration is completed. The Teal Ruby mission, known by its primary Defense Advanced Research Projects Agency (DARPA) payload of the same name, carries an Air Force, Army, and National Aeronautics and Space Administration secondary payload as well. The DARPA experiment will demonstrate new (mosaic) infrared technologies and collect data needed for the design of future space-based aircraft and missile detection systems. Under Project 2618 (Secondary Missions), after prelaunch checkout is completed, orbital support will be provided for an Air Force experiment being flown on a Defense Meteorological Satellite Program spacecraft to learn how to better predict auroral conditions affecting communications systems. One Project 2619 (Shuttle Experiment Support Equipment) activity is to complete the development of the early version of reusable sortie hardware supporting the first DOD Shuttle mission. Another activity is to begin procurement of needed additional, reusable Shuttle sortie hardware and to make modifications, as appropriate, to existing sortie hardware. This will provide a full complement of reusable hardware in support of future sortie missions and will enable exploitation of the Shuttle as a manned space laboratory. Within Project 2620 (Shuttle Experiment Support Equipment), all mission activities will be completed to support the flight of the first DOD Shuttle mission, a sortie mission scheduled for flight on the

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

fourth Orbital Flight Test. Prior to launch, the payloads will be integrated on the early version sortie hardware and then tested. The composite structure will then be integrated on the Shuttle. Lessons learned will be documented for future DOD users. This mission is referred to by the name of its primary payload--Cryogenic Infrared Radiation Instrumentation for Shuttle (CIRIS). The CIRIS payload will collect data on the infrared emissions from the earth's atmosphere and from the Shuttle environment. The earth emission data will help in the

The Shuttle environment (contamination) data will help design future infrared Shuttle sortie payloads. This mission will additionally provide DOD with the early experience needed to learn how to use the Shuttle. Another project activity is to start the design activities for the next Shuttle sortie mission.

The reductions in FY 1981 and FY 1982 program funds compared with those projected in the FY 1981 Descriptive Summary are a result of Air Force funding priorities. The primary impact was the purchase delay of much of the hardware needed for exploitation of the Shuttle as a manned laboratory, delaying programs such as the Space Infrared Experiment (SIRE) and Talon Gold. Fortunately, the use of the previous Program hardware has enabled STP to fly the CIRIS mission even sooner than the previously scheduled 1984 SIRE mission. Options to possibly fly SIRE and Talon Gold earlier than now scheduled are under evaluation. SIRE completes the needed earth emission data and provides additional background and a future space-based surveillance system.

4. (U) FY 1983 Planned Program: Project 2617 (Spacecraft Missions) activity will complete total system checkout of Teal Ruby Spacecraft, integrate the spacecraft and its mounting structure on Shuttle, and provide orbital support after launch. Under Project 2618 (Secondary Missions), the National Aeronautics and Space Administration (NASA) will provide technical support and flight acceptance testing for the four Space Test Program experiments planned for launch from the Kennedy Space Center on the NASA Long Duration Exposure Facility reusable, freeflying satellite. The satellite launch and retrieval dates are subject to NASA scheduling. Current plans reflect an on-orbit mission of over 12 months. One experiment will allow determination of space environmental effects on spacecraft materials; another will examine the space effects on active/passive radiation-hardened fiber optics components. Project 2619 (Shuttle Experiment Support Equipment) continues the procurement of additional reusable Shuttle sortie hardware. Project 2620 (Shuttle Sortie Missions) continues the design and mission operation efforts for Shuttle sortie missions.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

Project: #2617

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Spacecraft Missions

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports the spaceflight of payloads on Space Test Program (STP) developed spacecraft. The missions are launched using STP expendable launch vehicles (Thor, Atlas, Titan, Delta, and Scout) or the Shuttle. Inertial Upper Stages (IUSs) are used for orbits requiring them. When practical, STP uses standardized boosters and spacecraft modules to increase the probability of mission success.

(U) RELATED ACTIVITIES: Atlas-F vehicles and launch support are provided by Space Boosters, Program Element (PE) #35119F. Shuttle launch support and Inertial Upper Stage (IUS) systems are provided by Space Launch Support, PE #35171F. Payloads are supported by the following: Office of Naval Research; Naval Research Laboratory; Army Atmospheric Sciences Laboratory; Defense Advanced Research Projects Agency (DARPA), PE #62301E, PE #62711E, and PE #62701E; National Aeronautics and Space Administration (NASA); Atmospheric Sciences, PE #61102F; Geophysics, PE #62101F; Materials PE #62102F; Space Surveillance Technology, PE #63428F; Satellite Systems Survivability, PE #63438F; Space Vehicle Subsystems, PE #63401; and Advanced Space Communications, PE #63431F.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the program. Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. The primary contractor for the Teal Ruby spacecraft is Rockwell International, Seal Beach, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: Since 1967, 15 primary missions, successfully carrying 61 payloads, have been launched using three Thor eight Atlas, two Titan IIIC, one Delta, and one Scout launch vehicles. The most recent missions were successfully launched in 1979: Spacecraft Charging at High Altitudes (SCATHA) on a Delta 2914 from Cape Canaveral Air Force Station and Gamma Ray Spectrometer on an Atlas-F from Vandenberg Air Force Base. The Air Force/Navy/NASA SCATHA mission is carrying 12 experiments to learn how to protect spacecraft in geosynchronous orbit from transient outages and electric malfunctions caused from spacecraft charging, thus improving their survivability. The Gamma Ray Spectrometer mission, known by its primary DARPA payload of the same name, carries six secondary payloads. The objective of the Gamma Ray spectrometer payload is to demonstrate the feasibility of a

In FY 1980, orbital support and data reduction support were continued for these latter missions. Also, the Teal Ruby spacecraft structure was completed and many of its modules were fabricated.

2. (U) FY 1981 Program: Data reduction support will be continued for the SCATHA and Gamma Ray Spectrometer missions. Also, most of the major modules will be integrated on the Teal Ruby spacecraft structure and independently tested.

3. FY 1982 Planned Program: Total system checkout of the Teal Ruby spacecraft will be initiated after the payloads have been integrated to spacecraft. The Teal Ruby mission, known by its primary Defense Advanced Research

Project: #2617

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Spacecraft Missions

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

Projects Agency payload of the same name, carries three payloads. The Teal Ruby experiment objectives are:

One of the secondary payloads is to test the National Aeronautics and Space Administration's (NASA) Mercury Ion Thruster, a millipound thruster for long-term station-keeping applications. Another secondary payload is to test an Air Force experiment to demonstrate new laser communication technologies. The third payload is to test an Army Extreme Ultraviolet (EUV) photometer.

4. (U) FY 1983 Planned Program: During this period, the total system checkout of the Teal Ruby spacecraft will be completed, the spacecraft with its supporting structure will be mounted in the Shuttle, and orbital support will be provided after launch.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional To Completion	Total Estimated Costs
		Estimate	Estimate	Estimate		
RDT&E	20,900	21,800	14,900	14,000	Continuing	Not Applicable

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

RDT&E	20,900	13,525	15,885	Continuing	Not Applicable
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(U) Reasons for the increase in FY 1981 compared to that projected last year for this period include the following: the contractor's underestimate of effort to resolve technical problems, delay in the Teal Ruby payload delivery due to payload development problems, cost growth in some of the subcontracts, and the need to compensate for higher Shuttle acoustic levels than NASA originally projected.

Project: #2619

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Shuttle Experiment Support Equipment

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is for the procurement of reusable, basic standard equipment and corresponding flight safety analyses to enable economical use of the Shuttle as a manned laboratory to support sortie experimentation. The sortie support system is comprised of three types of sortie support equipment: flight hardware mounted in the Orbiter bay and Orbiter aft flight deck; support and test equipment required to test, support, and maintain the sortie support equipment; and mission/payload specialist training equipment required to train Orbiter flight crews and support personnel in use of sortie support equipment. Sortie support equipment includes: a cradle structure on which to mount experiments; a gimballed pointing system for orienting experimental sensors at space and ground objects; a communications and data handling system which will provide for command, telemetry, data routing, storage, security, caution and warning, and data processing; a manned operations system enabling a mission/payload specialist to interact/control experiments (includes a graphics display, a keyboard, switches, status indicators, a hand controller, and a secure voice link for communications with ground personnel); an electrical power system which will receive its primary power from the Orbiter power bus; and a thermal control system which will use the Orbiter heat exchanger cooling system. The design of the sortie support equipment will incorporate features compatible with "class cargo certification." The class cargo analytical certification process that will be performed is intended to minimize repetitive Shuttle integration verification analyses and tests by qualification of a worst-case requirements envelope to include experiment configuration, its position within Orbiter, thermal, electromagnetic compatibility, contamination, and safety requirements. Mission/payload specialist equipment will include an aft flight deck mockup, hardware/software required to simulate the cargo bay and aft flight deck equipment, and a training computer system to execute software.

(U) RELATED ACTIVITIES: Maximum utilization will be made of hardware, software, and data developed or being developed by the DOD, National Aeronautics and Space Administration, European Space Agency, and others.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA is responsible for the hardware procurements. Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. Potential bidders include Rockwell International, Seal Beach/Downey, CA; TRW, Redondo Beach, CA; RCA, Hightstown, NJ; McDonnell Douglas, Huntington Beach, CA/Huntsville, AL; Martin Marietta Aerospace, Denver, CO; Sperry Rand Corporation Space Support Division, Huntsville, AL; General Electric CO, Valley Forge, PA; Hughes Aircraft Corporation, Culver City, CA; Lockheed Aircraft Corporation, Sunnyvale, CA; General Dynamics Corporation, San Diego, CA; and Boeing, Seattle, WA; and European Space Agency contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: After completing the Request for Proposals (RFP) document on Shuttle sortie hardware, the RFP was released followed by start of proposal evaluation.
2. FY 1981 Program: In FY 1981, two funding cuts occurred in the Space Test Program budget due to Air Force funding priorities: one in FY 1981 and one in FY 1982. Also, the opportunity arose then to capitalize on the reusable Shuttle sortie support hardware begun under the now cancelled Program. The decision was made for the Space Test Program to continue the development of the Program hardware and to delay its original plans for full procurement

Project: #2619

Program Element: #63402F

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Shuttle Experiment Support Equipment

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

of the sortie hardware needed to exploit the Shuttle as a manned space laboratory. Although the hardware is limited in capability, it is considered an early version of that needed for Shuttle exploitation with noncomplex, minimally man-aided experiments. The use of this hardware enables support of an important, early DOD Shuttle sortie mission in 1982 not possible otherwise. Also, within this project, documentation is being generated for all DOD Shuttle users. It will cover common integration procedures of sortie payloads with the Space Transportation System, launch procedures, and methods of training and operation.

3. (U) FY 1982 Planned Program: The development of the early version reusable sortie hardware will be completed and used to support the first DOD Shuttle mission. Also, action will begin to procure additional reusable Shuttle sortie hardware and to make modifications, as appropriate, to existing sortie hardware. This is to obtain a full complement of reusable hardware in support of future sortie missions.

4. (U) FY 1983 Planned Program: The procurement will continue for the additional needed reusable Shuttle sortie hardware.

5. (U) Program To Completion: This is a continuing program.

6. (U) Milestones: Not Applicable

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimate</u>
						<u>Costs</u>
RDT&E	4,900	12,900	24,700	38,100	Continuing	Not Applicable

8. (U) Comparison With FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
		<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimate</u>
						<u>Costs</u>
RDT&E	11,200	31,195	45,835		Continuing	Not Applicable

(U) The reductions in the FY 1981 and FY 1982 project funds compared with those projected in the FY 1981 Description Summary are a result of Air Force funding priorities at the program level. A primary impact is to delay the purchase of much of the hardware needed for exploitation of the Shuttle as a manned laboratory. This action will delay some sortie missions.

Project: #2620

Program Element: #63402F

DOD Mission Area: Space Launch & orbital Support, #410

Title: Shuttle Sortie Missions

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This project supports the spaceflight of Shuttle sortie missions, initially defined as those in which the main experiment equipment remains in the Shuttle bay and is operated either by automatic control or by a mission/payload specialist during the short time the Shuttle is on orbit. This project provides for the integration of DOD experiments with the sortie support system as a sortie mission payload, the integration of the sortie mission payload by the National Aeronautics and Space Administration (NASA) (through the DOD payload integration contractor), mission/payload specialist training, on-orbit support, and sortie support system refurbishment.

(U) RELATED ACTIVITIES: Shuttle launch support is provided by Space Launch Support, Program Element 35171F. Payloads flown are provided by the Military Services or DOD agencies.

(U) WORK PERFORMED BY: The United States Air Force, Headquarters Space Division, Los Angeles, CA, is responsible for spaceflight planning, engineering, procurement, and operational aspects required to execute the program. Systems engineering support is provided by the Aerospace Corporation, Los Angeles, CA. The primary contractor for the first Shuttle sortie mission is Lockheed Missiles and Space Company, Sunnyvale, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 And Prior Accomplishments: Design and hardware modifications were made for flight of the Air Force Space Sextant experiment as a secondary mission on host Program hardware. The Space Sextant was previously scheduled for flight in 1981 on the Satellite Infrared Experiment spacecraft cancelled in 1979. Now that Program was cancelled in early FY 1981, the Space Sextant will be flown as one of the experiments on the first Space Test Program Shuttle sortie mission using the Program hardware. Other activities included examination of how various Space Test Program experiments could best exploit man and definition of the training that would be required for his use.

2. (U) FY 1981 Program: The design and mission planning efforts are being performed for flight of the first DOD Shuttle mission, a Shuttle sortie mission. This mission is known by the name of its primary payload--Cryogenic Infrared Radiation Instrumentation for Shuttle (CIRIS). The use of man is being examined for this mission.

3. FY 1982 Planned Program: All mission activities will be completed for the flight of the first mission on the fourth Orbital Flight Test. Prior to launch, the payloads will be integrated on the early version sortie hardware and then tested. The composite structure will then be integrated on the Shuttle. Lessons learned will be documented for future DOD users. One of the mission payloads, CIRIS, is a long wavelength infrared high spectral resolution instrument which can help verify design concepts. Additionally, the earth emission data that will be collected will help in the design of.

CIRIS can also determine the Shuttle contamination environment affecting future infrared payloads. Another payload is the Space Sextant, a gimbaled and highly-precise autonomous navigational and attitude reference system. Also, design activities will begin for the next Shuttle sortie mission.

Project: #2620

Program Element: #63402P

DOD Mission Area: Space Launch & Orbital Support, #410

Title: Shuttle Sortie Missions

Title: Space Test Program

Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1983 Planned Program: Design and mission operation efforts will continue for Shuttle sortie missions.

5. (U) Program To Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>To Completion</u>	<u>Estimate</u>
						<u>Costs</u>
RDTE	2,045	4,900	7,300	12,700	Continuing	Not Applicable

8. (U) Comparison With FY 1981 Budget Data:

RDTE	1,000	8,580	15,375	Continuing	Not Applicable
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The reduction in FY 1981 and FY 1982 project funds compared with those projected in the FY 1981 Descriptive Summary are similar to those at the program level. The reductions are a result of Air Force funding priorities. The primary program impact was to delay the purchase of much of the hardware needed for exploitation of the Shuttle as a manned laboratory, delaying important programs such as the Space Infrared Experiment (SIRE) and Talon Gold. Fortunately, the use of residual hardware from Program will enable STP to fly another important early sortie mission even sooner than the previously scheduled 1984 SIRE mission. This early Cryogenic Infrared Radiation for Shuttle (CIRRS) mission will collect important Shuttle contamination data and earth emission data for the possibly fly SIRE and Talon Gold earlier than now scheduled are under evaluation. SIRE completes the needed earth emission data and provides additional background and surveillance system.

Options to
and a future space-based

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #63707F

DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Advanced Development)

Budget Activity: Defense-wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands) 1/

Project Number	Title	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
		Actual	Estimate	Estimate	Estimate		
TOTAL FOR PROGRAM ELEMENT		0	2669	2900	3600	Continuing	Not Applicable

1/ The numbers contained within this Descriptive Summary are correct. However, they are at variance with the R-1 document due to late administrative action.

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force critically needs the ability to observe and collect essential weather information in battle areas not under friendly control. Employment of precision guided munitions requires specific environmental information unique to the weapon's sensing systems which is not available through present weather observing and forecasting techniques. This program develops the technology to gather required weather information and process it for use by battle staff planners and aircrews to insure effective employment of conventional or precision guided munitions under battlefield conditions.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request provides funds for development of prototype sensors to observe and collect battlefield weather data. Platforms for delivery of weather sensor packages will be evaluated. It includes development of application techniques for these data to present and planned advanced weapon systems such as precision guided munitions using infrared, visible, and millimeter (radar) wavelength sensors. Funding amounts are based on initial cost estimates by Air Force Systems Command.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
		Estimate	Estimate	Estimate		
	0	700	600		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #63707F

DOD Mission Area: Global Military Environmental Support, #420

Title: Weather Systems (Advanced Development)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Employment of precision guided munitions and conventional weapons relies heavily on environmental conditions suitable for accurate delivery. Conventional munitions are limited by visibility and cloud base in tactical operations. Sensing systems employed by present and planned precision guided munitions require specific visibility and background information in their sensing regimes (infrared, millimeter wave, electro-optical). None of this information is currently available from present weather sensors for uncontrolled or enemy controlled battle areas. A system is necessary to gather the critical information required from uncontrolled or hostile battle areas, along with techniques to process and apply the information to insure effective employment of present and planned weapons systems. Fixed/bare base support requirements have similarly unique sensor needs. Development of sensor packages to provide critical weather information in the tactical arena is essential to effective tactical operations.

(U) RELATED ACTIVITIES: Results of advanced development projects in this Program Element are implemented through Program Element 64707F, Weather Systems (Engineering Development) and Program Element 35111F, Weather Service (Other Procurement). FY 1981 Science and Technology Program Apportionment Review to Under Secretary of Defense for Research and Engineering provided a forum for triservice coordination of efforts in Battlefield Forecasting Techniques. The Defense Atmospheric Transmission Plan is the focal point for support of precision-guided munitions delivery. Working level contact with the Army and Navy continues, avoiding unnecessary parallel development of techniques and systems.

(U) WORK PERFORMED BY: Program Management is provided by Air Force Geophysics Laboratory, Hanscom AFB MA. Technical work for this new Program Element will be accomplished by Air Force Wright Avionics Laboratory, Air Force Armament Test Laboratory, and contractors.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable.
2. (U) FY 1981 Program: This new program initiates sensor development to provide currently unavailable information for support to tactical operations. Specific sensors being developed will be expendable visibility meters for use at visible and infrared wavelengths, and a low-cost, fast-response humidity sensor. Two approaches to characterize cloud cover, tops and bases, will be evaluated for feasibility. They are remote broadband radiometry and in place measurements. Current and planned passive satellite imagery will be evaluated for capability to provide required data. A sensitivity analysis of the data requirements will be accomplished to specify the accuracy and resolution requirement for tactical sensor measurements. Two efforts were transferred from Program Element 64707F, Weather Systems, to Program Element 63707F, Weather Systems, which accounts for the change in FY 1981 funds. First, advanced development of tactical decision aids to support infrared-based precision guided munitions was transferred. This effort was initiated in FY 1980 when no 63707F Program Element was available. Second, advanced development of software associated with the Next Generation Weather Radar was transferred since this work will be accomplished by Air Force Geophysics Laboratory. Both of these efforts will support Program Element 64707F, Weather Systems, related projects.

Program Element: #63707F

DOD Mission Area: Global Military Environmental Support #420

Title: Weather Systems (Advanced Development)

Budget Activity: Defense-wide Mission Support #6

3. (U) FY 1982 Program: Two major thrusts are planned for FY 1982. The first is the evaluation of all potential platforms for delivery of tactical weather sensor packages into uncontrolled and hostile areas. Manned, unmanned recoverable and expendable alternatives will be investigated to determine the most appropriate method of delivery. The second major thrust is analysis of the sensitivity of millimeter wave systems to environmental conditions and the specification of critical weather data for millimeter wave weapons. The selection of delivery mode will be critical to the overall sensor package size and weight limitations necessary for sensor package integration. The millimeter wave effort will identify sensor requirements and also impact sensor package integrations. Two efforts were transferred from Program Element 64707F, Weather Systems, to Program Element 63707F, Weather Systems, which account for the increase in FY 1982 funds. These include development of tactical decision aids to support infrared-based precision guided munitions advanced development and development of software associated with the Next Generation Weather Radar.
4. (U) FY 1982 Planned Program: Sensors will be integrated into system packages to satisfy requirements for tactical employment data. Development of tactical decision aids for millimeters wave precision guided munitions will begin. Weather data requirements for fixed/bare base tactical operations will be defined. Sensitivity analysis will be performed to determine level of sensor performances needed to satisfy these tactical operations requirements.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title: Advanced Aerial Target Development

Budget Activity: Defense Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Continuing	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	13,474	15,067	12,300	13,900	Continuing	Not Applicable
2459	Target Auxiliary Systems	174	667		3,500	Continuing	Not Applicable
2535	QF-100 Full Scale Aerial Target	4,100	6,100	2,000			15,400
469A	Firebolt (formerly High Altitude High Speed Target)	9,200	8,300	10,300	9,400	5,300	52,700
2684	Missile Attitude Measurement System				1,000	8,400	9,400

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Aerial target development is a key factor needed to insure combat effectiveness and crew proficiency in the employment of our tactical forces against enemy threats. The overall objective is to improve air-to-air weapon system accuracies and reliability by developing aerial target systems for aircrew training and weapon system evaluation. The targets being developed will help provide a proper mix of full-scale, sub-scale and gunnery tow targets. The auxiliary systems will increase effectiveness of targets by providing representative radar and infrared threat signature. The Firebolt is being designed to simulate high altitude high speed threats which our new weapons will encounter. Improvement in weapon attitude and position scoring will reduce training costs and make possible more thorough weapon evaluation.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Firebolt (High Altitude High Speed Target) will be flight tested during Development Testing and Evaluation. Engineering design and documentation will be completed and support equipment will be fabricated. Development testing of the QF-100 will be completed at Holloman Air Force Base, NM at which time production effort will begin. Firebolt and QF-100 cost estimates based on firm fixed-price contracts and test center estimates for ground and flight testing.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:							Total
RDT&E		FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Continuing	Estimated Costs
		16,500	16,900	19,400		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS (\$ in thousands):

Procurement (Missile)(PE 35116F)(Project 469A)	13,600	Continuing	Not Applicable
(Quantity)	12		
Procurement (Missile)(PE 35116F)(Project 2535)	16,500	97,100	147,300
(Quantity)	21	144	216

Program Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title Advanced Aerial Target Development
Budget Activity Defense Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program includes full-scale development of the Firebolt high altitude high speed target vehicle and the conversion of the F-100 to the QF-100 Full Scale Aerial Target. The Firebolt project will provide threat simulations in the supersonic high altitude spectrum and replace the depleting inventories of BQM-34F and CQM-10B targets. The Full-Scale Aerial Target project will include design and integration of remotely controlled autopilot modifications, command and control telemetry devices, programmable maneuver profiles, and scoring system on a fighter aircraft being retired from the active inventory. This program also provides for the advanced development and validation of target systems and subsystems and the development of technologies to continuously improve Air Force and Tri-Service threat simulation capabilities. The Target System Technology project provides for technology development at the system and subsystem level addressing deficiencies of existing targets. The project includes analysis, development, and test in the areas of infrared augmentation, radar augmentation, threat radio frequency emission, scoring technology, and vehicle technology. Tasks are elevated to project status when appropriate to provide for improved threat simulation with existing or advanced targets.

(U) RELATED ACTIVITIES: The Air Force, Army, and Navy are actively involved in the development of various target systems and subsystems. A Joint Logistics Commanders' Panel studied the Tri-Service requirements and recommended a division of tasks which will insure a cooperative effort. The Air Force is evaluating the Army-developed MQM-107 and the Navy-developed BQM-74C to determine if either or both targets can provide a low-cost alternative to the BQM-34 target. Likewise, the Army and Navy are coordinating with the Air Force on requirements for the High Altitude High Speed Target. Tri-Service coordination is conducted frequently to assure non-duplication of efforts. Under the Joint Logistics Commanders, a Joint Service Operational Requirement for Aerial Targets has been developed. This Joint Service Operational Requirement identifies deficiencies, recommended programs and lead Service for development. When ready for production, systems are procured under PE 35116F, Aerial Target Drones.

(U) WORK PERFORMED BY: The office of primary responsibility within the Air Force is the Armament Division, Eglin Air Force Base, FL. There are several industry contractors involved with Armament Division including: Radar augmentation - Teledyne Ryan, San Diego, CA; Radio Corporation of America, Phoenix, AZ; Infrared Augmentation - Hayes International, Huntsville, AL; Firebolt vehicle prime contractor - Teledyne Ryan Aeronautical, San Diego, CA; Target Control System - Precision Laboratory, Vienna, VA; Firebolt rocket/ramjet - United Technology, Sunnyvale, CA; Digidops Scoring System - Cartwright Engineering Incorporation, Anaheim CA; QF-100 Full Scale Aerial Target Sperry Flight Systems, Phoenix, AZ. The Gulf Coast Test Range at Tyndall Air Force Base FL, and White Sands Missile Range, NM, conducts flight tests of all systems under development by the Armament Division. The Air Force Test and Evaluation Center is responsible for Firebolt Operational Test and Evaluation.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Tri-Command Required Operational Capability (ROC) 502-77 was validated and planning was completed for the Firebolt full-scale development. Competitive selection for the Firebolt program was complete and preliminary design review was conducted in October 1980. Engineering Development of the QF-100 Full-Scale

Program Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title Advanced Aerial Target Development
Budget Activity Defense Wide Mission Support, #6

Aerial Target (conversion of an F-100 aircraft) was initiated in August 1979. Contractor first flight of the QF-100 was successfully demonstrated October 1980. Target Auxiliary System effort continued with completion of Vector Miss Distance Indicator (VMDI) System evaluation. The VMDI will be followed by development of a less complex and more reliable scoring system employing laser transmitter/receiver concepts. The A/A 37U Gunnery Tow Target was flight tested on the P-4.

2. (U) FY 1981 Program: Critical design review will be conducted for the Firebolt. Prototype and environmental testing as well as test bed flights will continue. Payload development (scoring and radar augmentation) will be completed for the QF-100 full scale target and flight testing will be conducted. Target system technology efforts will again emphasize infrared and radar augmentation and radio frequency emission/electronic countermeasure.
3. (U) FY 1982 Planned Program: Firebolt vehicle design and qualification testing will be completed and development test vehicles fabricated. Development test and evaluation will also be initiated for Firebolt. Flight testing of the QF-100 will be completed with a production decision planned for January 1982. Firebolt cost estimates based on a firm fixed price, multi-year contract and test center estimates for flight test.
4. (U) FY 1983 Planned Program: Production decision on Firebolt will follow completion of Development Test and Evaluation and Initial Operational Test and Evaluation will be initiated. Advanced concepts in precise scoring using low power laser transmitter and receivers on the target will be evaluated through ground demonstrations. The Missile Attitude Measurement System for accurately determining weapon position and attitude will begin development.
5. (U) Program to Completion: This program is a continuing effort. The Firebolt development test and evaluation and Initial Operational Test and Evaluation will be completed in FY 1984 leading toward full production go-head in mid FY 1984. Technology activities will continue on developing improved, more accurate scoring and tracking systems for aerial targets. Further study for development of new target vehicles and the necessary subsystems and payload will proceed to provide threat representative targets for training and weapons testing for the three Services.
6. (U) Milestones: Not Applicable

Project: #469A

Program Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title: Firebolt (Formerly High Altitude High Speed Target)

Title: Advanced Aerial Target Development

Budget Activity: Defense Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The High Altitude Target successfully completed its technical feasibility flight demonstrations, and advanced development was halted in FY 1977 pending a formal requirement and its validation. The requirement for a High Altitude High Speed Target was validated in November 1977. Full scale development of Firebolt in response to the required operational capability, was initiated in FY 1980. Firebolt will provide threat simulation target presentations for evaluation of weapons systems and aircrew training. This system is necessary because of the performance characteristics of emerging threats and the depletion of the limited performance CQM-10B (BOMARC) targets.

(U) RELATED ACTIVITIES: The Firebolt development has drawn heavily on the expertise and data collected in the High Altitude Supersonic Target work done in Program Element 63232F. In addition, the Digidops scoring system, radar augmentation and Drone Target Control System will be integrated on the Firebolt.

(U) WORKED PERFORMED BY: The office of primary responsibility within the Air Force is the Armament Division, Eglin Air Force Base, FL. There are several industry contractors involved with Armament Division including: Radar augmentation - Teledyne Ryan, San Diego, CA; Radio Corporation of America, Phoenix AZ; and Target Control System - VEGA Precision Laboratory, Vienna, VA. The Gulf Coast Test Range at Tyndall Air Force Base FL conducts flight tests of all systems under development by the Armament Division. The Firebolt vehicle prime contract was awarded Teledyne Ryan, San Diego, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Contract was awarded December 1979 to Teledyne Ryan and subsequent subcontracts were awarded for engine, recovery system, power unit and drone tracking and control system. Preliminary Design review was held October 1980.
2. (U) FY 1981 Program: Performance and recovery testing using residual Advanced Development models will be completed. Improved components and subsystems will be integrated with test bed vehicles for flight test and evaluation. Fabrication of Engineering vehicles will be initiated. Critical design review will be conducted in third quarter FY 1981.
3. (U) FY 1982 Planned Program: First Engineering Development Vehicles will be delivered and Development Test and Evaluation will begin with fifteen planned flights. Long lead for production will be released. Support equipment will be developed and tested in conjunction with development flight test.
4. (U) FY 1983 Planned Program: Development Test and Evaluation will be completed and Initial Operational Test and Evaluation will be initiated. Production tooling will be initiated in preparation for FY 1984 start of production.
5. (U) Program to Completion: Long lead production release is planned for October 1982. Development Test and Evaluation will be completed in FY 1983. Initial Operational Test and Evaluation will be completed during FY 1984. Plans include twenty-five Initial Operational Test and Evaluation flights. Production decision is scheduled for FY 1984.

Project: #469A

Program Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title: Firebolt (Formerly High Altitude High Speed Target)
Title: Advanced Aerial Target Development

Budget Activity: Defense Wide Mission Support, #6

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	9,200	8,300	10,300	9,200	5,300	52,700

(U) OTHER APPROPRIATIONS FUNDS (\$ in Thousands)

Target Vehicle Procurement (Missile)
(Quantity)

13,600
10
Continuing
N/A

8. (U) Comparison with FY 1980 Budget Data:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RD&E	11,000	10,000	14,000		14,500	83,400 1/

(U) OTHER APPROPRIATIONS FUNDS:

Not Applicable

1/ Includes \$27.6 million for the High Altitude Supersonic Target (HAST) under Program Element 63232F which was a predecessor to the current Firebolt program.

Project: #2535

Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title: Full Scale Aerial Target Program

Title: Advanced Aerial Target Development

Budget Activity: Defense Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The QF-100 Full Scale Aerial Target is intended to replace the PQM-102 beginning in FY 1983. Full Scale engineering development was initiated in FY 1979 to convert F-100 aircraft retired from the active inventory to the QF-100 for target drone operation. The QF-100 Full Scale Aerial Target project will include design and integration of remotely controlled autopilot modifications, command and control telemetry devices programmable maneuver profiles, and a Scalar or Vector Miss Distance Indicator scoring system. The QF-100 will provide a realistic fighter threat simulation for test and evaluation of weapons systems and aircrew training.

(U) RELATED ACTIVITIES: The QF-100 Full Scale Aerial Target will use the same technology previously applied to the PQM-102 target drone. The Vector Miss Distance Indicator or Digidops scoring system and Drone Target Control System will be integrated into the Full Scale Aerial Target.

(U) WORK PERFORMED BY: The office of primary responsibility is the Armament Division, Eglin Air Force Base, FL. There are several industry contractors involved with Armament Division including: Drone Target Control System - VEGA Precision Laboratory, Vienna, VA; Digidops Scoring System - Engineering, Incorporation Anaheim, CA; and the Prime Vehicle Contractor - Sperry Flight Systems, Phoenix, AZ.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The Full Scale Aerial Target prime contract was awarded to Sperry Flight System in August 1979 for full scale engineering development. Contractor first prototype ready for flight test at end of FY 80.
2. (U) FY 1981 Program: Contractor development test and evaluation flight tests will be initiated, followed by Air Force development test and evaluation flights.
3. (U) FY 1982 Planned Program: Initial Operational Test and Evaluation will be completed and deficiencies will be corrected. The production decision is scheduled for March 1982.
4. (U) FY 1983 Planned Program: All major development efforts expected to be complete by FY 1983. Correction of deficiencies and additional refinement of scoring and auxiliary systems will be established.
5. (U) Program to Completion: The program will be completed in FY 1983.
6. (U) Milestones: Not applicable.

Project: #2535

Element: #64211F

DOD Mission Area: Aerial Targets, #452

Title: Full Scale Aerial Target Program

Title: Advanced Aerial Target Development

Budget Activity: Defense Wide Mission Support, #6

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
ROT&E	4,100	6,100	2,000			15,400

(U) OTHER APPROPRIATIONS FUNDS (\$ in Thousands):

QF-100 Target Vehicles (Missile)
(Quantity)

15,500	29,200	88,100	131,800
21	51	228	300

8. Comparison with FY 1981 Budget Data:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
ROT&E	5,500	6,200	2,200			15,600

((U) OTHER APPROPRIATIONS FUNDS:

Not Applicable

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64223F

DOD Mission Area: Airborne Strike, #113

Title: Alternate Fighter Engine

Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate 35,000	FY 1983 Estimate TBD	Additional to Completion TBD	Total	
							Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT								

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED. Provides funds to extend the previous, highly successful efforts on the F101 Derivative Fighter Engine (DFE) under PE 64218F, Engine Model Derivative Program (EMDP), to maintain the option for a full scale development should a firm requirement develop. Currently the Air Force is restricted to an F100 engine or its derivatives for any high thrust, afterburning turbofan fighter engine application through the eighties. This program maintains the option of the F101 DFE as a competitive alternative to the F100 for these applications.

(U) BASIS FOR FY 1982 RDT&E REQUEST. Provides a transition to maintain the option of a full scale development of the F101 DFE. Includes funds for system optimization engineering, additional testing, and test hardware. Extends the technology demonstration which will be completed in FY 1981 under EMDP to accomplish additional durability testing and additional engineering aimed toward transitioning into a full scale development if a firm requirement develops.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not Applicable.

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64223F

DOD Mission Area: Airborne Strike, #113

Title: Alternate Fighter Engine

Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The F101 Derivative Engine (DFE) Program was one of the first programs to be included in the Engine Model Derivative Program (EMDP). The EMDP fills a void which existed in the engine development process for 10 years by permitting the demonstration of potential of derivatives of current engines. The F101 DFE was a fighter version of the B-1 engine, the F101. It consisted of the same core as the F101 with scaled technologies of the F404 in the fan and augmentor. The three year EMDP effort on the F101 DFE will be completed in FY 1981 with the F-16 and F-14 flight tests. The test results to date of the F101 DFE have been very successful and have confirmed the design emphasis on reliability and durability. After a series of ground tests simulating 1000 equivalent mission hours for the F-16, the hardware exhibited so little wear that the same hardware is now being tested to 1000 equivalent mission hours for the F-14. The flight tests in an F-16 test bed have confirmed the altitude tests at the Arnold Engineering Development Center which demonstrated stable, highly responsive operation throughout the envelope. The engine performance during the technology demonstration meets or exceeds predictions. This Program Element was initiated to provide a transition to full scale development if a firm requirement develops. It will maintain the option of the F101 DFE as a competitive alternative for a mid-to-late eighties application.

(U) RELATED ACTIVITIES: This program continues the development of the F101 DFE which was initiated under Program Element #64218F, Engine Model Derivative Program (EMDP). The EMDP on the F101 DFE was conducted under a Memorandum of Understanding with the Navy. The Navy is conducting flight tests in an F-14 in late FY 1981.

(U) WORK PERFORMED BY: The program is managed by the Aeronautical Systems Division, Deputy for Propulsion, Wright-Patterson AFB, OH. The F101 DFE program is being conducted by the General Electric Company, Evendale, OH.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Efforts conducted under EMDP.
2. (U) FY 1981 Planned Program: Efforts conducted under EMDP.
3. (U) FY 1982 Planned Program: The engineering efforts on the F101 DFE will shift to system optimization. The test program will include 150 hours of testing at the Arnold Engineering Development Center and 400 hours of accelerated mission testing. Component testing of items such as the fan, turbine, and fuel control will also be included. Long lead for additional test hardware will be procured as part of the FY 1982 program.
4. (U) FY 1983 Planned Program: TBD
5. (U) Program to Completion: TBD
6. (U) Milestones: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64227F

Title: Flight Simulator Development

DDO Mission Area: Non-System Training Devices, #430

Budget Activity: Defense-Wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT								
2201	B-52 Aerial Refueling/KC-135 Boom Operator Part Task Trainers	400					9,400	
2269	B-52 Electro-Optical Viewing System	2,000					7,900	
2325	Simulator Development Activities	700	1,249			Continuing	Not Applicable	
2360	Tactical Combat Trainer	3,200	4,300			Continuing	26,300	
2769	Simulator Update Development 1/			26,500		Continuing	Not Applicable	
1/ Reflects FY 1982 and FY 1983 funding directed by DPS 164. Reflects R-1 administrative error.								

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This is a continuing program element for the engineering development of aircrew flight simulation techniques and training devices. Increasing costs of flying hours, limited airspace and reduced energy resources point to the need for development of synthetic training devices capable of training the full spectrum of the Air Force mission roles. The objective of this element is to adapt flight simulation technology developed in the laboratories and industry for satisfying current training requirements. Prototype training devices and subsystems developed under this element will be evaluated for training effectiveness and supportability prior to follow-on production decisions and/or integration with training devices in acquisition.

(U) BASIS FOR FY 1982 RDT&E REQUEST: A conscious decision in formulation of the Fiscal Year 1982 budget eliminated total development of the Tactical Combat Trainer visual system. The program emphasis was changed to focus on only critical technology development. Generic visual system development will be concentrated on fidelity and scene content visual requirements. Efforts will be continued in optimizing radar simulation software. The validity of cost estimates is based on parametric analysis.

(U) COMPARISON WITH FY 1982 DESCRIPTIVE SUMMARY:

	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	6,300	17,700	27,200		Continuing	Not Applicable	

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

Program Element: #64227F

DOD Mission Area: Non-System Training Devices, #430

Title: Flight Simulation Development

Budget Activity: Defense-Wide Mission Support, #6

- (U) DETAILED BACKGROUND AND DESCRIPTION: This Program Element was started to conduct programs and activities normally accomplished as part of the development phase of the acquisition cycle, but are inappropriate to fund with procurement funds programmed for simulator acquisitions. The B-52 Aerial Refueling Part Task Trainer (ARPTT)/KC-135 Boom Operator Part Task Trainer (BOPTT) project is for development of prototype devices which will be used to evaluate the feasibility of substituting ground training for airborne training in aerial refueling tasks. These PTTs consist of a B-52 cockpit and a KC-135 boom operator situation with camera-model visual systems to display the required visual scene. The B-52 Electro-Optical Viewing System (EVS) project is for development of a prototype real time simulation of the B-52 EVS (forward-looking infra-red, low flight level television) display using the Defense Mapping Agency Digital Data Base and Computer Generated Imagery for the B-52 Weapon System Trainer. It will provide training for B-52 pilots and navigators in the low level penetration mission. The project for Simulator Development Activities provides the Program Director flexibility in funding quick response and consultative efforts. Activities are conducted on a continuing basis in the areas of systems requirements, trade-off analysis, modular design studies, test instrumentation, and data reduction. The Tactical Combat Trainer (TCT) project is for competitive prototype development and evaluation of dual interactive cockpit wide field-of-view visual systems. The visual system will be used for training tactical air-to-air combat and air-to-ground weapons delivery. The TCT development is structured to effectively combine varied research elements into a cohesive system which will permit a comprehensive evaluation of visually aided aircrew training. Significant efforts being combined in the TCT development are high resolution area of interest, multiple moving targets and electronic warfare (EW) correlation with the visual system including terrain occulting.
- (U) RELATED ACTIVITIES: Projects in this element rely on the technologies from inter-service coordination of technology base programs. This element relies heavily on the Air Force Human Resources Laboratory technological base programs. Specific programs which support this element are: PE 62205F, Training and Simulation Technology; PE 63227F, Advanced Simulator Development; PE 63715F, Innovations in Education and Training.
- (U) WORK PERFORMED BY: The Deputy for Simulators, Wright-Patterson Air Force Base, OH is the in-house organization responsible for the majority of this element. The only in-house efforts are the KC-135 BOPTT and some tasks within the Simulator Development Activity project. The major contractors for the remaining projects are: Redifon Flight Simulation, Ltd, Crawley, England (B-52 ARPTT); the Boeing Military Airplane Company, Wichita, KS (B-52 EVS); Singers-Link Division, Binghamton, NY (B-52 EVS and TCT) and General Electric, Simulation and Control Systems Department, Daytona Beach, FL (TCT). The Training System Manager at Ogden Air Logistics Center, Hill Air Force Base, UT is responsible for the update development for existing simulators.
- (U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:
1. (U) FY 1980 and Prior Accomplishments: Procurement of data and support equipment for the B-52 ARPTT and KC-135 BOPTT was completed and development contracts closed out. Test and evaluation of the B-52 EVS was conducted with the Qualification Operational Test and Evaluation (QOT&E) of the B-52 WST pilot production units. Production decision was made and prototype upgrade to the production configuration started. Development of the TCT was continued at a reduced level due to FY 1980 budget constraints.

Program Element: #64227F

DOD Mission Area: Non-System Training Devices, #430

Title: Flight Simulator Development

Budget Activity: Defense-wide Mission Support, #6

2. (U) FY 1981 Program: Upgrade of the B-52 Electro-Optical Viewing System (EVS) to production configuration will be completed. Based on reduced funding, the Tactical Combat Trainer (TCT) program will be restructured to focus on critical technology development. Efforts will be concentrated on image generation and display elements. The purpose of this limited development will permit acceleration of a full visual system given adequate support in the budget process.
3. (U) FY 1982 Planned Program: Efforts will be concentrated on improving software processing of digital data used in image display systems. Fidelity and scene content studies will be conducted for both airlift and fighter visual simulation requirements. Development of updates to existing B-52, C-135 and F-106 simulators will be initiated in Project 2769. Initiate EF-111 capability in electronic warfare simulators.
4. (U) FY 1983 Planned Program: The only planned effort in Project 2325 is for studies to determine approved methods for processing digitally generated radar data. Update development for existing B-52, C-135, F-106, and electronic warfare simulators will be completed.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.

Project: #2769

Program Element: #64227F

DOD Mission Area: Non-System Training Devices, #430

Title: Simulator Update Development

Title: Flight Simulator Development

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This project is a new initiative intended to comply with budget guidance. For updates requiring significant changes, particularly software, it is necessary that development funding be utilized for first article update efforts. It is intended that this project will be a continuing effort to satisfy those simulator updates which meet the criteria for development funding.

(U) RELATED ACTIVITIES: The only activities directly related to this project are follow-on updates subsequent to initial unit update development and future updates which would meet development funding criteria.

(U) WORK PERFORMED BY: The Air Force Logistics Command Training System Manager located at Ogden Air Logistics Center, Hill Air Force Base, UT, has the responsibility for managing updates under this project. Depending on the simulators involved and the nature of this update, the actual development will be performed by the simulator manufacturer or by a competitive contractor selection.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: None. This project is a new initiative in FY 1982.
2. (U) FY 1981 Program: None. This project is a new initiative in FY 1982.
3. (U) FY 1982 Planned Program: Initial update development for existing F-106, B-52, and C-135 simulators will be started. The F-106 effort will convert the simulators from analog to digital technology for increased fidelity and closer compatibility to the aircraft. The B-52D simulator effort will consist primarily of conversion to a digital computer. The C-135 simulator will digitize the communication and navigation systems. This update is required to insure cockpit configuration concurrency and logistic supportability. The Simulator for Electronic Warfare Training (SEWT) will be upgraded with EF-111A capability.
4. (U) FY 1983 Planned Program: The initial update development started in FY 1982 will be completed.
5. (U) Program to Completion: This will be a continuing project for updates requiring development funding.

6. (U) Milestones: Not applicable.

7. (U) Resources:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RD&E	0	0	26,500	TBD	Continuing		0
(U) Comparison with FY 1981 Budget Data:	0	0	0	0	0		0

RD&E

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: 64411F (63411F)

Title: Space Shuttle
Budget Activity: Defense-wide Mission Support, #6

DOD Mission Area: Space Launch and Orbital Support, #410

(U) RESOURCES (\$ in Thousands):

TOTAL FOR PROGRAM ELEMENT

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	205,900	245,865	266,000	256,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: To increase the effectiveness of defense space operations, this program will: (1) Support the National Aeronautics and Space Administration development and assure the utility to the Department of Defense of the Space Transportation System; (2) Transition critical national defense satellites to the Shuttle; (3) Develop the Inertial Upper Stage; and (4) Acquire general purpose Shuttle launch and landing facilities at Vandenberg Air Force Base, CA. The Air Force, as the Department of Defense executive agent, is responsible for the planning, development, integrated logistics support and activation activities necessary to achieve these objectives.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Continues the acquisition of the Vandenberg Ground Support System leading to an initial launch capability in August 1984. Continues the Inertial Upper Stage full scale development phase to provide an initial launch capability in early 1982. Costs for the Vandenberg and Inertial Upper Stage developments have increased significantly from earlier projections. Continues acquisition of airborne support equipment, payload integration equipment, and the Shuttle Payload Integration Facility in preparation for Department of Defense Shuttle launches from Kennedy Space Center in 1982. Implements the "Controlled Mode" for secure Department of Defense mission operations at Johnson Space Center, Houston, TX to support a first secure launch in 1983. Controlled mode modifications to Kennedy Space Center and Goddard Space Flight Center - similar to those at Johnson Space Center - also begin for protection of classified Department of Defense information and operations at those facilities.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E (PE 63411F/64411F)	206,900	230,100	187,800		Continuing	Not Applicable
Procurement (Missile) (PE 12449F)	162,500	131,093	93,227		Continuing	Not Applicable
Procurement (Other) (PE 12449F)	25,151	24,022	12,341		Continuing	Not Applicable
Military Construction (PE 12449F)	74,700	127,100	14,300		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
Procurement (Missile) (PE 12449F)	137,446	117,034	212,365	113,916	Continuing	Not Applicable
Procurement (Other) (PE 12449F)	25,821	16,978	6,487	7,289	Continuing	Not Applicable
Military Construction (PE 12449F)	74,700*	98,500**	38,190***	21,810	Continuing	Not Applicable

* Does not include other MILCON reprogrammed to fund overruns for Vandenberg launch pad (\$63,700) or Orbiter Maintenance and Checkout Facility (\$5,200)

** Does not include other MILCON reprogrammed to fund overrun for Vandenberg launch pad (\$13,700)

*** Does not include projected reprogramming requirement for Vandenberg launch pad (\$5,000)

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Program Element: 64411F (63411F)

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Shuttle

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Space Task Group, established by the President in 1969, recommended that a Space Transportation System be developed to provide more flexible and effective access to space at lower costs than current expendable launch vehicles. In January 1972 the President authorized the National Aeronautics and Space Administration to proceed with the development of the reusable Space Shuttle as a national means for transporting payloads to and from space. The Space Transportation System consists of the Space Shuttle Vehicle which will carry payloads to low earth orbit and return to land on a runway; upper stages to transfer payloads from low earth orbit to higher orbits; and associated ground and airborne support systems. The Space Shuttle Vehicle consists of the Orbiter (the winged, recoverable spacecraft the size of a DC-9), an External Tank containing fuel and oxidizer for the Orbiter's main engines, and a pair of recoverable Solid Rocket Boosters which will provide initial boost acceleration for the vehicle. The reusable Orbiter will carry the payload (spacecraft and, if required, upper stage) into orbit in its 15x60 foot payload bay. The system will have the capability to boost 32,000 pounds of payload to a near-polar (98°) orbit, or 65,000 pounds into an Easterly (28.5°) orbit. After reentry, the Orbiter will land on a runway using a high speed, unpowered approach. The Orbiter and Solid Rocket Boosters will be recovered, refurbished, and reused. The facilities at the two launch bases; Kennedy Space Center, FL and Vandenberg Air Force Base, CA; accomplish the recovery, refurbishment, and reintegration of the major components of the Space Shuttle Vehicle to prepare it for its next launch. The National Aeronautics and Space Administration mission control center at Johnson Space Center will be used for mission planning and control.

(U) The Air Force participates in the Shuttle program to assure that critical national defense missions will continue to be effectively supported. Although National Aeronautics and Space Administration is responsible overall for the Space Transportation System, the Air Force defines Department of Defense operational and support requirements and assesses the effect of Shuttle design changes on Department of Defense national security missions. The Air Force addresses the unique Department of Defense needs to assure the maximum operational utility of the expanded space mission capability offered by the Shuttle. In addition, the long term advantages of the Shuttle to Department of Defense appear to be substantial - particularly in the areas of payload retrieval, on-orbit repair, assembly of very large structures in space, and the availability of an orbital test bed -- modes of operation unavailable without the Shuttle.

(U) To minimize the operational impact and cost of modifying Department of Defense payloads, and to make early effective use of the Shuttle, the Department of Defense and National Aeronautics and Space Administration agreed that the Air Force will develop an expendable upper stage for use with the Shuttle; this stage is called the Inertial Upper Stage. The Inertial Upper Stage will ease the transition to the Shuttle by being used first on the Titan launch vehicle for certain Department of Defense payloads which will be later launched on the Shuttle. The Inertial Upper Stage will be operational on the Shuttle coincident with the first payload operational need dates at the Kennedy Space Center. The Inertial Upper Stage will be used on Shuttle by both Department of Defense and National Aeronautics and Space Administration for all large, high altitude payloads.

(U) The Department of Defense has also agreed to acquire and operate the Space Shuttle launch and landing facilities at Vandenberg Air Force Base, CA with a target initial launch capability date of August 1984. This agreement was reached after an extensive study determined that Department of Defense and National Aeronautics and Space Administration

Program Element: 64411F (63411F)

Title: Space Shuttle

DOD Mission Area: Space Launch and Orbital Support, #410

Budget Activity: Defense-wide Mission Support #6

requirements could not be satisfied from one launch site, and that use of a second site at Vandenberg was necessary for polar orbit missions. The heavier near-polar missions cannot be accomplished from the Kennedy Space Center, FL since that would require overflight of the continental United States while sub-orbital and result in the large Shuttle external tank being released on a ballistic trajectory over the Sino-Soviet land mass for impact in the Indian Ocean.

(U) RELATED ACTIVITIES: This program is directly related to, and paced by, the National Aeronautics and Space Administration Space Shuttle development program. Under current agreements, National Aeronautics and Space Administration will fund for all Shuttle Orbiters, provide the general purpose launch and landing facilities at Kennedy Space Center, FL and perform Shuttle mission control at Johnson Space Center, Houston, TX. The Department of Defense portion of the program will include the development of the Inertial Upper Stage, the acquisition and operation of Space Shuttle facilities at Vandenberg Air Force Base, and the funding for the unique Department of Defense security requirements levied on the National Aeronautics and Space Administration-developed Space Transportation System elements. A joint National Aeronautics and Space Administration/United States Air Force Space Transportation System Committee, co-chaired by the Assistant Secretary of the Air Force (Research, Development, and Logistics) and the Associate Administrator for Space Transportation System Acquisition (National Aeronautics and Space Administration), assures that the Space Transportation System will meet the needs of both agencies. Department of Defense payload planning efforts are addressed by the Department of Defense Space Shuttle User Committee which includes representatives of the Army, Navy, Air Force, Office of the Secretary of Defense, and Joint Chiefs of Staff. The Air Force Director of Space Systems and Command, Control, Communications chairs this body and also has the responsibility for research and development efforts involving Air Force payloads, expendable launch vehicles and the Shuttle program. Inertial Upper Stage production, Vandenberg operation and maintenance, and Shuttle flight charges paid to National Aeronautics and Space Administration for United States Air Force users are funded under Program Element 35171F (Space Launch Support). Inertial Upper Stage flight equipment and operation and Shuttle flight charges for other Department of Defense users are funded by the users program element. Titan/Inertial Upper Stage integration is funded under Program Element 3519F, Space Boosters. Related activities for near term utilization of the Space Shuttle sortie mode capabilities are being pursued by the Space Test Program under Program Element 63402F. The Air Force is planning a Consolidated Space Operations Center, funded under Program Element 35130F to eliminate the vulnerabilities represented by the single critical control nodes of the Satellite Test Center (payload control) and Johnson Space Center (shuttle control).

(U) WORK PERFORMED BY: The Air Force Space Division, El Segundo, CA of the Air Force Systems Command is the development agency for the Air Force Space Shuttle activities. The Aerospace Corporation, El Segundo, CA provides Space Division with general systems engineering support. Martin Marietta (Denver), Vandenberg Air Force Base, CA was awarded the contract for the detailed design criteria for Vandenberg Shuttle facilities and for development of support equipment and software specifications. Martin Marietta is also the payload integration contractor. Rockwell International, Downey, CA and United Space Boosters, Huntsville, AL provide expertise on the Orbiter and the Solid Rocket Boosters respectively in support of the Vandenberg Shuttle facilities design and activation. Boeing Aerospace Corporation, Seattle, WA was awarded the contract for Inertial Upper Stage full scale development and is also performing spacecraft to Inertial Upper Stage integration activities. TRW Systems, Redondo Beach, CA is supporting development of the secure Shuttle mission control capability at the Johnson and Kennedy Space Centers. International Business Machines, Houston, TX is under contract to evaluate specialized Orbiter flight software for Department of Defense missions.

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Program Element: 64411F (63411F)

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Shuttle

Budget Activity: Defense-wide Mission Support #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Preliminary Department of Defense system level requirements for the Space Transportation System were developed in 1971 and continue to be refined.

(U) Inertial Upper Stage: After completion of the Validation Phase and following a March 1978 Defense Acquisition Review Council Milestone II Review, the Full Scale Development Phase began. The Department of Defense standard two stage Inertial Upper Stage configuration was baselined at the system Critical Design Review during 1979. The development of a three stage, planetary version of the Inertial Upper Stage was also begun with funding provided by the National Aeronautics and Space Administration. Problems with development of the Inertial Upper Stage solid rocket motors and the flight software caused a stretch in the development program and increased the total development cost -- but did not impact user launch needs. The full scale development contract will continue into 1983 for completion of the two stage Inertial Upper Stage development and delivery of nine pre-production vehicles (four funded by the Department of Defense and five funded through the National Aeronautics and Space Administration). The procurement of long lead materials for the follow-on production began, with funding provided by the National Aeronautics and Space Administration; Program Element 35171F, Space Launch Support; and Program Element 34111F, Special Activities. Inertial Upper Stage processing modifications to the Solid Motor Assembly Building began at Cape Canaveral Air Force Station, FL.

(U) Vandenberg Air Force Base: Engineering design activities for the Vandenberg Ground Support System continue, keyed to the construction of Vandenberg Air Force Base facilities. The multi-year construction program began in January 1979 with modifications to the existing launch pad. Construction of the second package of Vandenberg Air Force Base Shuttle facilities began and included the Orbiter Maintenance and Checkout Facility, the first cell of the Hypergolic Maintenance and Checkout Facility, the Titan solid rocket booster storage facility relocation, utilities, and modification to the launch pad to incorporate provisions for handling a thrust augmented Orbiter. Design of unique Department of Defense ground support equipment and software development for the launch processing system began. Procurement of unique ground support equipment was initiated, and co-procurement continues for ground support equipment and launch processing equipment common to Vandenberg Air Force Base and Kennedy Space Center. Equipment installation and checkout began for the Launch Control Center and the North Vandenberg launch processing system computers.

(U) Operations Capability: Payload integration activities continue to support early Department of Defense Shuttle flights. Design and development continues on interface verification equipment to support early Department of Defense flights from Kennedy Space Center. Analysis of payload processing requirements for Kennedy Space Center-launched Department of Defense missions resulted in development of the requirements for the Shuttle Payload Integration Facility; this "off-line" processing facility constitutes additional modifications to the Solid Motor Assembly Building (also being modified to process the Inertial Upper Stage) which will begin in FY 1981. Modifications to allow the Johnson Space Center to conduct classified Department of Defense Shuttle missions (termed "controlled mode") were identified and implementation begun. Studies of the Kennedy Space Center security requirements were completed and showed the need for modifications similar to those being done at Johnson

Program Element: 64411F (63411F)

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Shuttle

Budget Activity: Defense-wide Mission Support #6

Space Center. Independent software validation and verification activities continue for all aspects of Shuttle software development under Department of Defense management. Conceptual studies of large space structures were completed and indicated that such structures are technically achievable when mission requirements dictate.

2. (U) FY 1981 Program: The Inertial Upper Stage development continues to meet an initial operational date in Fiscal Year 1982. Included in the full scale development program are the fabrication of nine pre-production vehicles to meet early operational requirements and long leads for the eight vehicles in the first production buy. The Inertial Upper Stage production phase is planned to begin following a Defense Systems Acquisition Review Council Milestone III Review. Funding for the pre-production units and the long leads is provided by the using programs. Development was terminated on the National Aeronautics and Space Administration-funded three stage planetary Inertial Upper Stage configuration. NASA will develop a Shuttle compatible version of the Centaur to accomplish the planetary launches. The Vandenberg AFB Ground Support System equipment installation continues and checkout begins on facilities begun in the FY 1979 and FY 1980 construction programs. Construction begins on the facilities in the third Vandenberg Air Force Base military construction package: the Solid Rocket Booster Refurbishment and Subassembly Facility, the Airfield and Mate/Demate Facility, the External Tank Storage and Checkout Facility, transportation upgrades, and logistics facilities. The installation and checkout of the "Controlled Mode" hardware and software continues at Johnson Space Center. Similar security-oriented modifications continue at Kennedy Space Center and begin at Goddard Space Flight Center (Goddard is the mission planning and system control center for the Tracking and Data Relay Satellite System -- the primary Shuttle command and control link and a multi-user payload data relay satellite planned to support civil and Department of Defense space operations). Modifications to the Solid Motor Assembly Building at Cape Canaveral Air Force Station, FL begin to create the Shuttle Payload Integration Facility to process Department of Defense payloads for Shuttle launch. Payload integration nears completion for the initial flights and continues for later flights.

3. (U) FY 1982 Planned Program: Development of the two-stage Inertial Upper Stage continues with analysis of the first Titan/Inertial Upper Stage and first Shuttle/Inertial Upper Stage flights. Delivery of the majority of the remaining pre-production vehicles is planned. Development will be complete with the flight and subsequent analysis of the ninth pre-production vehicle in 1983 (a National Aeronautics and Space Administration mission). Inertial Upper Stage production continues (funded by Program Element 35171F, Space Launch Support, for Air Force payloads; by the user for other Department of Defense programs; and through NASA for civil/commercial missions). The Vandenberg Ground Support System installation and checkout continues toward an initial launch capability in August 1984 to support civil Defense missions projected for that year. Significant cost increases occurred in the Vandenberg development and procurement funding estimates due to increased concurrency with the Kennedy (East Coast) launch site development, inflation factor increases and support equipment cost increases. The construction funded in the 1982 program includes the Solid Rocket Booster Retrieval and Disassembly Facility, harbor modifications, the Parachute Refurbishment Facility, the Integrated Operations Support Center, flight crew facilities, and the Space and Missile Test Organization Management and Engineering Facility relocation. These projects (and a possible Fiscal Year 1983 Tile Processing Facility) will complete the initial facility set, provide an initial capability of six launches per year, and allow moderate growth (to a ten to twelve flights per year) as requirements dictate. Construction of the Shuttle Payload Integration Facility is completed. Modifications to Kennedy and Johnson

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Title: Space Shuttle

Budget Activity: Defense-wide Mission Support #6

Space Centers to allow classified processing ("controlled mode") will be completed to support the first classified mission in 1983. Modifications to Goddard Space Flight Center continue to allow classified data to be used in mission planning for the Tracking and Data Relay Satellite System. Payload integration activities continue.

4. (U) FY 1983 Planned Program: Inertial Upper Stage flights continue using pre-production vehicles. Inertial Upper Stage production continues (funded by the user programs). The Vandenberg Ground Support System construction, equipment installation, and checkout continues toward the August 1984 first launch capability. Construction is completed on most of the major facilities (Orbiter Maintenance and Checkout Facility, External Tank Storage and Checkout Facility, and the Launch Pad). Equipment installation is completed on the external tank and launch pad facilities. Ground system test and the integrated system test (ground system and flight vehicle elements) begin. A flight-proven Orbiter arrives from Kennedy Space Center aboard the Shuttle Carrier Aircraft to support the integrated systems testing. Construction begins on the Tile Processing Facility (if required). The Shuttle Payload Integration Facility at Kennedy Space Center reaches its initial operational capability. "Controlled Mode" at Johnson Space Center reaches its full operational capability. Payload integration continues on schedules compatible with the launch requirements of the individual payloads.

5. (U) Program to Completion: Vandenberg activation continues at a rate determined by projected launch requirements. If necessary, a final construction package (currently projected for Fiscal Year 1984) will be used to remove Shuttle processing restrictions and allow growth to 20 evenly spaced launches per year by mid-1986. Additional facilities are also projected for FY 1984 to add the National Aeronautics and Space Administration selected option for a thrust augmentation capability (to support a mid-1986 National Aeronautics and Space Administration Spacelab mission). Payload integration activities continue as all Department of Defense payloads transition to the Shuttle.

Program Element: #64411F (63411F)

Title: Space Shuttle
Budget Activity: Defense-wide Mission Support #6

DOD Mission Area: Space Launch and Orbital Support, #410

6. (U) Milestones:

	<u>Date</u>
A. Vandenberg Air Force Base Design Criteria Start	Oct 75
B. Inertial Upper Stage Validation Phase Start	Sep 76
C. Inertial Upper Stage Full Scale Development Start	Apr 78
D. Vandenberg Air Force Base Construction Start	Jan 79
E. Inertial Upper Stage Initial Launch Capability (Titan)	*(Jul 81) Apr 82
F. Johnson Space Center Controlled Mode Initial Operational Capability	Mar 82
G. Kennedy Space Center Security Modifications Complete	Jun 82
H. Inertial Upper Stage Initial Launch Capability (Shuttle)	*(Sep 81) Jul 82
I. Kennedy Space Center Shuttle Payload Integration Facility Operational Capability	Dec 82
J. Johnson Space Center Controlled Mode Final Operational Capability	Dec 82
K. Goddard Space Flight Center Security Modification Initial Capability	Apr 83
L. Vandenberg Air Force Base Initial Operational Capability	*(Dec 83) Aug 84
M. Goddard Space Flight Center Security Modification Final Capability	Dec 84
N. Vandenberg Air Force Base Full Operational Capability	*(Jul 85) Jul 86
O. Vandenberg Air Force Base First Thrust-Augmented Launch	*(Jul 85) Jul 86

*Date presented in FY 81 Descriptive Summaries.

(U) Explanation of Milestone Changes:

E. & H. The initial launch capability for both the Titan and Shuttle versions of the Inertial Upper Stage have slipped due to late deliveries of vendor parts to the prime contractor for qualification testing and due to software development and testing delays. In both cases, there is no mission impact from the delay since the payloads scheduled for these launches have also been delayed.

N. & O. The Vandenberg Full Operational Capability and first thrust-augmented launch dates have also been delayed with no mission impact. Current national space launch traffic projections show one year delays in both requirements.

L. The Vandenberg Initial Operational Capability was slipped by a delay in beginning the construction of the critical path item - the launch pad. The construction start delay was caused by the requirement to analyze and process a reprogramming action for additional funds when all the bids for launch pad construction substantially exceeded the budgeted amounts.

Budget Activity: Defensewide Mission Support, #6
Program Element: #64411F - Space Shuttle

Test and Evaluation Data:

1. (U) Development Test and Evaluation: This is a unique National program. The National Aeronautics and Space Administration and the Air Force are each developing, acquiring and operating a portion of the common-use hardware and facilities. The National Aeronautics and Space Administration has the development and operation responsibilities for the Space Shuttle Vehicle, the East Coast Shuttle launch and landing facilities at Kennedy Space Center, FL and the Mission Control Center at Johnson Space Center, TX. The Department of Defense is developing the Inertial Upper Stage and will develop and operate the West Coast Shuttle launch and landing facilities at Vandenberg Air Force Base, CA. The Air Force is planning a Consolidated Space Operations Center funded under PE 35130F for a fiscal year 1986 operational capability to augment and backup the present satellite control capabilities of the Satellite Control Facility, Sunnyvale, CA and to provide a dedicated Department of Defense Shuttle control capability. National Aeronautics and Space Administration verification activities do not recognize the distinction between developmental and operational testing and Air Force developed systems do not include hardware for exclusive test use. Consequently, Air Force test and evaluation activities are being conducted as a combined Development Test and Evaluation/Operational Test and Evaluation program.

(U) Department of Defense Assessment of National Aeronautics and Space Administration Segments: The Air Force Systems Command -- with Air Force Test and Evaluation Center participation and support from other Air Force agencies -- will assess the capability and the availability of the National Aeronautics and Space Administration developed segments to support Department of Defense requirements. This evaluation activity consists primarily of monitoring and evaluating major Space Transportation System verification events conducted by the National Aeronautics and Space Administration.

(U) Air Force test participation began with monitoring of the Approach and Landing Tests conducted at Edwards Air Force Base, CA from February 1977 to March 1978. These tests successfully demonstrated the low speed flying and manual landing characteristics of the Orbiter vehicle as well as the adequacy of the ferry capability of a modified Boeing 747 Shuttle Carrier Aircraft. Subsequently, the Mated Vertical Ground Vibration Test, conducted at the Marshall Space Flight Center from March 1978 to February 1979, was monitored. This test satisfactorily provided the required information to validate the analytical model used to design and verify the structural capability of the Space Shuttle Vehicle and, subsequently, update the predictive models used to calculate the environments seen by Department of Defense payloads while in the Shuttle payload bay.

(U) Progress of the Space Shuttle Main Engine development has been continuously monitored since January 1978 due to its critical role in Space Shuttle Vehicle performance and schedule. The engine has performed at full power (109% of rated power level); however, hardware design and reliability problems have caused major program delays. The Main Propulsion Test at the National Space Technology Laboratories, MS began in April 1978. After ten successful tests, including four at full flight duration (540 to 578 seconds) and rated power level, most of the objectives vital for first manned orbital flight have been achieved. However, in July 1980, a hole burned through the fuel preburner combus-

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Budget Activity: Defensewide Mission Support, #6
Program Element: #64411F - Space Shuttle

tion zone liner and housing, terminating the test. Redesign and development have delayed the Main Propulsion Test. Two Main Propulsion Test firings, at 102% of rated power level, are scheduled in late 1980 and are necessary prerequisites for the Flight Readiness Firing of the space shuttle main engines prior to First Manned Orbital Flight. Additional Main Propulsion Test firings at full power level (109%) are required by 1982 to certify readiness of the Space Shuttle Vehicle for full operational capability.

(U) The Shuttle Avionics Integration Laboratory at Johnson Space Center is used to verify avionics hardware and software compatibility and to provide confidence in the ability of these subsystems to successfully perform the flight sequences planned for the Orbital Flight Test program and subsequent missions. This ongoing program started in March 1979 and has been successful in identifying and correcting a number of hardware and software configuration discrepancies. The Air Force will continue monitoring the test progress and results from this activity.

(U) The Orbital Flight Tests (four flights scheduled from April 1981 through 1982) will conclude the Air Force participation in formal National Aeronautics and Space Administration verification activities. Since all Department of Defense concerns will not be answered during the Orbital Flight Tests, Air Force test activity will continue through at least the twentieth Space Transportation System launch.

(U) IUS Test Program: A Defense Systems Acquisition Review Council Milestone II review of the Inertial Upper Stage program was held in March 1978 and approved proceeding with full scale development. The Boeing Aerospace Company is on contract for the full scale development phase. The Defense Systems Acquisition Review Council also approved production of an initial quantity of nine Inertial Upper Stage vehicles (five National Aeronautics and Space Administration, four Department of Defense) to meet planned flight schedules. Because of the high cost and immediate operational use of Department of Defense developed Space Transportation System flight hardware (there will be no dedicated test launches of an Inertial Upper Stage), a combined Development Test and Evaluation/Operational Test and Evaluation program is being conducted. The Inertial Upper Stage test and evaluation will focus on system performance, reliability, maintainability, and compatibility with the Space Transportation System.

(U) The most critical Inertial Upper Stage development items are avionics component qualification, flight software and the long-duration burn solid rocket motors.

(U) Qualification testing of the Inertial Upper Stage avionics began in August 1979 and is currently estimated to be completed early in 1981. The primary problem affecting the avionics system is the unavailability of high reliability space-qualified electronic piece parts.

(U) In the Inertial Upper Stage software area, the flight software is being developed by TRW and tested at the Boeing Aerospace Corporation facility in Kent, WA. The prototype flight software has been designed, coded and tested. The operational flight software development continues with coding of the operational flight software completed by TRW and code modules now in integration testing at TRW (to be followed by

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Budget Activity: Defensewide Mission Support, #6
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verification a validation testing at the Boeing Systems Integration Laboratory). Martin Marietta Corporation will start independent verification and validation work in January 1981. The mission data loads are being designed for the first three Department of Defense spacecraft and for the first National Aeronautics and Space Administration-sponsored Tracking and Data Relay Satellite. Development and validation and verification testing of the operational software in time to support an initial launch date of April 1982 of a Titan III(34)D/Inertial Upper Stage is proceeding.

(U) Propulsion system development testing is proceeding rapidly. To date seven solid rocket motor cases have been burst tested and four cases have been skirt tested. Preliminary results were below design criteria, but additional wraps on the case have produced adequate margin. Two burst and two skirt tests remain to be completed. Nine Inertial Upper Stage motors have been fired at the Arnold Engineering and Development Center, TN. All have been successful and have achieved nominal performance values. These include four large (first-stage) and five small (second-stage) motors. One motor firing included the Extendable Exit Cone which was deployed prior to the test. Three motors remain to be fired in the development test program which should be complete in February 1981. Twelve additional motors (six small and six large) will be fired for the qualification test program. These firings will begin after completion of development testing and continue through December 1981. Currently the major technical problem remaining open in the propulsion area is cracking of the propellant in the boot area of the solid rocket motor which has been observed on four motors. The probable cause of this cracking has been identified, and a proposed solution involving a propellant processing change formulated. This fix will be confirmed by X-rays of four qualification motors (two of each size) prior to casting the first flight motor.

(U) The development phase of Inertial Upper Stage/booster separation and shock testing was completed on a development test vehicle in November 1978 and demonstrated that the actual shock spectrum was less than predicted. Structural qualification testing of the Titan T34D configuration was initiated in April 1980 and was completed in September 1980. Qualification of the Space Transportation System configuration will commence in February 1981 and is expected to be completed in June 1981. The Inertial Upper Stage qualification test vehicle structure has been completed and the vehicle, using inert solid rocket motors, has been stacked. Power-on testing of the qualification test vehicle commenced in October 1980.

(U) The ground test portion of the Inertial Upper Stage program will be concluded with a series of environmental simulation tests to be performed on the qualification test vehicle at Boeing and with processing of the Inertial Upper Stage Pathfinder vehicle through each of the steps at Cape Canaveral Air Force Station and Kennedy Space Center required to process an Inertial Upper Stage for an operational launch.

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(U) Vandenberg Air Force Base Ground Support System Testing: The Martin Marietta Aerospace Company is on contract to complete the requirements definition, equipment specification, and facilities design criteria for the Vandenberg Air Force Base launch and landing site. Facilities construction and equipage is in progress with Martin as the prime contractor. Ground Support System testing will focus on compatibility of ground processing with the Space Shuttle Vehicle, ground operations, supportability, Air Force manpower/resources, and contractor support. The test program will include acceptance testing of facilities, installation and ground system tests of support equipment, and integrated system tests of the Ground Support System with the flight vehicle hardware, leading to an initial launch capability target date of August 1984. A combined test program is planned to satisfy both development test and evaluation and operational test and evaluation objectives. In addition to the testing planned on Air Force designed unique ground support equipment for Vandenberg, the Air Force will ensure that the NASA designed common support equipment meets Department of Defense requirements, and will modify and test that equipment when appropriate. Much of the ground processing data obtained at Kennedy Space Center will be applicable to Vandenberg Air Force Base due to the similarity of Space Transportation System equipment, facilities, and procedures. Experience with preparing the Space Shuttle Vehicle for launch will allow the Vandenberg capability to grow to about 10-12 launches per year; an additional increment of facilities and equipment (currently planned for Fiscal Year 1984) will lead to full operational capability of 20 launches per year in mid-1986. The Ground Support System evaluation will continue through the Vandenberg Air Force Base full operational capability date.

(U) Operations Capability Development: All the activities (other than Inertial Upper Stage and Vandenberg) necessary to provide an orderly transition of Defense payloads to the Space Transportation System are included in this area: Inertial Upper Stage flight planning and control; incorporation of Department of Defense security requirement in National Aeronautics and Space Administration Shuttle systems, development of the facilities, hardware, and analytical services needed to integrate Department of Defense payloads into the Shuttle, and the documentation and services needed to effectively support Department of Defense Shuttle users. Test and evaluation for these activities is being planned as needed to support overall program milestones.

2. (U) Operational Test and Evaluation: Air Force test activities are being conducted as part of a combined Development Test and Evaluation/Operational Test and Evaluation program in which the Air Force Test and Evaluation Center will participate with the Air Force Systems Command in National Aeronautics and Space Administration activities, will independently evaluate and report on Department of Defense test activities, and will work with Air Force Systems Command to provide an overall systems level assessment of the Space Transportation System capability to meet Department of Defense requirements.

(U) Department of Defense Assessment of National Aeronautics and Space Administration Segments: Air Force Test and Evaluation Center will participate with Air Force Systems Command in monitoring and observing the National Aeronautics and Space Administration test activity and assessing the capabilities of the Space Transportation System. This evaluation activity will primarily consist of monitoring National Aeronautics and Space Administration Space Transportation System verification efforts, which will be conducted at the Kennedy Space Center, FL; Johnson Space Center TX; and Edwards

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Budget Activity: Defensewide Mission Support, #6
Program Element: #6411F - Space Shuttle

Air Force Base, CA. The primary focus of Air Force involvement in National Aeronautics and Space Administration activity will be to determine the availability and the capability of the Space Transportation System to support Department of Defense requirements.

(U) Inertial Upper Stage Test Program: Test and evaluation will focus on system performance, reliability and maintainability, and compatibility with the Space Transportation System. Inertial Upper Stage test activity will be performed at the Boeing facilities in Kent, WA, and Cape Canaveral Air Force Station, FL. The actual buildup and checkout of the Inertial Upper Stage will be handled by contractor personnel. Air Force Test and Evaluation Center will provide an independent evaluation and assessment of the Inertial Upper Stage test activity which begins with Inertial Upper Stage factory checkout and continues through the first shuttle launch of a Department of Defense payload by an Inertial Upper Stage vehicle.

(U) Vandenberg Air Force Base Ground Support System Test Program: The Ground Support System testing will focus on compatibility of ground processing equipment with the Space Shuttle Vehicle, ground operations, supportability, Air Force manpower/resources, and contractor support. Much of the ground processing data obtained at Kennedy Space Center will be applicable to Vandenberg Air Force Base due to the similarity of the Space Transportation System equipment, facilities, and procedures. The Operational Test and Evaluation test team will initially be located at Cape Canaveral Air Force Station to begin collecting data for the Ground Support System and will subsequently transition to Vandenberg Air Force Base during Fiscal Year 1983. The Ground Support System evaluation will continue through the Vandenberg full operational capability date (scheduled for late 1986). Air Force Test and Evaluation Center will provide an independent evaluation and assessment of the Vandenberg Air Force Base Ground Support System.

(U) Operations Capability Development: Air Force Test and Evaluation Center will participate in testing of the other Department of Defense segments and provide independent assessments of operational suitability and effectiveness.

Budget Activity: Defensewide Mission Support, #6
 Program Element: #64411F - Space Shuttle

3. System Characteristics: The key performance parameters of the National Aeronautics and Space Administration and Department of Defense developed segments are shown below:

NASA SEGMENT - SPACE SHUTTLE VEHICLE			
ITEM	OBJECTIVE	CURRENT ESTIMATE	REMARKS
		<u>DEMONSTRATED</u>	
Payload to 150 nautical miles 28° inclination	65,000 pounds	63,000 pounds	Baseline Reference Mission 1 Without Thrust Augmentation
Payload to 150 nautical miles 98° inclination	32,000 pounds	24,000 pounds	Baseline Reference Mission 4, Without Thrust Augmentation
AIR FORCE SEGMENT - INERTIAL UPPER STAGE			
ITEM	OBJECTIVE	CURRENT ESTIMATE	REMARKS
		<u>DEMONSTRATED</u>	
Payload to Geosynchronous (Shuttle Version)	5,000 pounds	5,016 pounds	With Extendable Exit Cone
Payload to Geosynchronous (Titan Version)	4,000 pounds	4,033 pounds	With Extendable Exit Cone
Reliability	0.96 (goal) 0.98 (threshold)	0.9825	
Accuracies			
Position	92 nautical miles	45 nautical miles	Shuttle Version at
Velocity	78 feet/second	32 feet/second	Geosynchronous
Inclination	0.12°	0.047°	altitude

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64735F

Title Improved Capability for Operational
Test and Evaluation (OT&E)
Budget Activity: Defense-wide Mission
Support, #6

DOD Mission Area: Other Test and Evaluation Support, #454

(U) RESOURCES (PROJECT LISTING): (\$ in Thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
	<u>TOTAL FOR PROGRAM ELEMENT</u>	<u>13,500</u>	<u>12,600</u>	<u>23,100</u>	<u>26,200</u>		
2152	Mission/Engineering Support	1,800	1,800	3,100	2,400		
2197	Scoring Systems	3,200	-0-	-0-	-0-		
2285	Threat Systems	7,000	8,800	15,500	19,800		
2286	Instrumentation	1,500	2,000	4,500	4,000		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Wartime experience has shown that a disproportionate number of losses occur among aircrews during their first ten combat missions. There is a continuing requirement to reduce those losses by more realistic training and testing. Additionally, the growing costs of modern weapon systems makes it imperative that the effective utilization of test and training resources be increased as much as possible. This program contributes to the qualitative improvement of combat operational forces by developing instrumentation and threat simulator systems to increase the effectiveness of the operational test, training and exercise ranges world wide.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request includes funds for three projects. The Mission/Engineering Support project primarily funds a Systems Engineering Technical Assistance contractor who will conduct engineering and management evaluations, and write specifications and statements of work. Instrumentation funds continued development of the Air Combat Maneuvering Instrumentation, and the Advanced Time-Space-Position-Instrumentation. The Missile End Game Evaluation Study and Envelope Scoring task will be completed. Threat Systems will fund completion of the Modular Threat Emitter, D-Band Communications Data Link Jammer, Tactical Strategic Command and Control and Visual Cueing. Development will continue on the AN/MSQ-T13. New efforts will include Ground Control Intercept Command and Control, the AN/MSQ-T11, I-Band Communication Data Link Jammer, the Laser Weapon, Modular Threat Emitter Update, Unmanned Threat Emitters and the Low Altitude Threat Radar. Cost estimates resulted from detailed independent cost estimates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Program to Completion Not Applicable
RDT&E	<u>12,200</u>	<u>12,700</u>	<u>26,300</u>			

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Program Element: #64735F

DOD Mission Area: Other Test and Evaluation Support, #454

(U) OTHER APPROPRIATION FUNDS:

Title: Improved Capability for Operational
Test and Evaluation (OT&E)

Budget Activity: Defense-wide Mission
Support, #6

	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>	
Procurement, Other (PE #27429F)	22,164	39,324	43,986	103,685	Continuing	Not Applicable	*
Procurement, Other (PE #27597F)	20,600	-0-	-0-	-0-	Completed	Not Applicable	*
Procurement, Other (PE #11897F)	10,280	14,407	17,528	40,217	Continuing	Not Applicable	*
Procurement, Aircraft (PE #27429F)	8,100	7,000	7,000	4,500	Continuing	Not Applicable	*

* (includes initial spares)

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Program Element: #64735F

Title: Improved Capability for Operational Test and Evaluation (OT&E)

DOD Mission Area: Other Test and Evaluation Support, #454

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: A Presidential Blue Ribbon Defense Report, Government Accounting Office (GAO) Reports and other documents identify deficiencies in the Air Force ability to conduct Operational Test and Evaluation (OT&E) and training in a realistic combat environment. These deficiencies have a direct impact on the combat effectiveness and survivability of strategic and tactical aircrews and weapon systems. Although much of the current OT&E and training is still conducted in an environment which provides little realistic threat simulation and poor measures of performance, this program, associated with the procurement programs is a part of the Air Force's overall "Range Improvement Plan". This program provides the front end by conducting full-scale engineering development efforts aimed at increased realism in test and training. It conducts numerous low cost efforts in instrumentation, simulation and scoring as a part of the integrated "Range Improvement Plan" noted above. The program will pay high dividends in eliminating the test and training deficiencies which currently exist. The end result will be improved weapon system effectiveness, increased aircrew combat proficiency, and a reduction in anticipated aircrew and weapon system combat losses.

(U) RELATED ACTIVITIES: This program element in conjunction with the procurement programs in PE 11897F and PE 27429F form the integrated USAF Range Improvement Program. This program is integrated with the other service's range modernization plans.

(U) WORK PERFORMED BY: This program is managed by the Armament Division, Eglin AFB, FL. Major contractors include Cubic Corp., San Diego, CA; General Dynamics, Ft Worth, TX; Emerson Electric Corp., St Louis, MO; and Metric Corp., Ft Walton Beach, FL.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In conjunction with the Navy, this program funded nonrecurring engineering associated with development of Air Combat Maneuvering Instrumentation (ACMI) which is now in operation in several locations. Also funded were ACMI related improvements for use in joint Navy/Air Force Air Combat and Air Intercept Missile Evaluations. Testing was completed on a remote television scoring system to provide weapon scoring on unmanned ranges. The majority of the work relating to Modular Threat Emitters, and a Radar Bomb Scoring System for Strategic Air Command was completed.

2. (U) FY 1981 Program: Development will be completed on the AN/MSY-T1 and continue on Air Combat Maneuvering Instrumentation, Advanced Time Space Positioning Instrumentation, the AN/MSQ-T13, Tactical Strategic Command and Control Dband Communications Data Link Jammer, and Modular Threat Emitters. New developments include a Missile End Game Evaluation Study, Envelope Scoring and Visual Cueing.

Program Element: #64735F

Title: Improved Capability for Operational Test and Evaluation (OT&E)

DOD Mission Area: Other Test and Evaluation Support, #454

Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1982 Planned Program: Development programs being completed are the Missile End Game Evaluation Study, Envelope Scoring, Tactical Strategic Command and Control, D-band Communications Data Link Jammer, and Modular Threat Emitters. New developments include I-Band Communications Data Link Jammer, the Laser Weapon, Modular Threat Emitter Update, Ground Control Intercept Command and Control, Low Altitude Threat Radar, Unmanned Threat Emitter and the AN/MSQ-T11. The FY 81-82 increase is due to the seven new program initiatives. These initiatives are required to provide our operational aircrews realistic training against modern Soviet electronic warfare systems.

4. (U) FY 1983 Planned Program: During this period, Advanced Time Space Positioning Instrumentation, the AN/MSQ-T13 and AN/MSR-T11 developments will be completed. Work will continue on the Low Altitude Threat Radar, Modular Threat Emitter Update, the Laser Weapon, I-band Communication Data Link Jammer, Ground Control Intercept Command and Control and Air Combat Maneuvering Instrumentation.

5. (U) Program to Completion: This is a continuing effort.

6. (U) Milestones: Not applicable.

Project: # 2285

Program Element: # 64735F

DOD Mission Area: Other Test and Evaluation Support, #454

Title: Threat Systems

Title: Improved Capabilities for OT&E

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Operational range deficiencies exist in the USAF ability to conduct operational training, testing and evaluation under realistic combat conditions. Realistic test and training programs can prevent costly errors in the estimated operational suitability and survivability of new weapon systems and the combat readiness of strategic, tactical, and air defense aircrews. This project seeks to correct deficiencies by developing replicas and emitter systems designed to simulate enemy surface-to-air missile fire control radars, anti-aircraft artillery gun laying radars, early warning and acquisition radars, jamming equipment, and air defense command and control systems. An emitter simulator will simulate some of the threat system's emitted characteristics. An emitter receiver simulator simulates some of the threat radar's radio frequency characteristics and provides some representation of its basic receiver and/or displays. An emitter-receiver processor simulator is an electrical representation of the threat radar system. A replica is a functional representation of the complete threat system.

(U) RELATED ACTIVITIES: Hardware developments under this project are coordinated with procurements programmed under Program Elements: 11897F, Training Offensive; and 27429F, Range Improvement Equipment. This project relates to PE 64738F, Protective Systems which provides enemy threat simulators for Development, Test and Evaluation.

(U) WORK PERFORMED BY: Tasks under this project are managed by Armament Division, Eglin AFB FL. The major contractors are General Dynamics, Fort Worth TX, Metric Systems, Fort Walton Beach FL, American Electronics Laboratory, Philadelphia PA, and Tasker Division of Whittaker, Chatsworth CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: A study of a command, control and communications system used by the enemy in air defense was completed and prototype simulators of enemy threat radars (such as the AN/MSQ-T13) were built. Work was initiated on the Modular Threat Emitters and duplicates of tactical command and control systems to be used in aircrew Electronic Counter Measures (ECM) training and equipment testing were developed. Work on the D-Band Communications Data Link Jammer was initiated and the Threat Training Systems Study was completed. Simulator Validation continues from previous years.
2. (U) FY 1981 Program: Work will be completed on the AN/MSY-T1 and the Ground Jammer. Work will continue on tactical/strategic command and control systems, D-Band Communications Data Link Jammer, AN/MSQ-T13, and the Modular Threat Emitter. There is one new start: development of a visual cueing system which visually simulates anti-aircraft artillery and surface to air missiles.
3. (U) FY 1982 Planned Program: Effort will be completed on the D-Band Communications Data Link Jammer, Tactical/Strategic Command and Control Systems, Modular Threat Emitter and Visual Cueing. Work continues on the AN/MSQ-T13. New simulator developments will include Ground Control Intercept Command and Control, I-Band Comm Data Link Jammer, Laser Weapon, Modular Threat Emitter Update, Low Altitude Threat Radar, Unmanned Threat Emitter and a tube for the AN/MSQ-T11.

Project: # 2285

Program Element: # 64735F

DOD Mission Area: Other Test and Evaluation Support, #454

Title: Threat Systems

Title: Improved Capabilities for OT&E

Budget Activity: Defense-wide Mission

4. (U) FY 1983 Planned Program: Continuing efforts include Ground Control Intercept Command and Control, I-Band Communications Data Link Jammer, Laser Weapon, Modular Threat Emitter Update and the Low Altitude Threat Radar. Efforts being completed include the AN/MSQ-T13 and the AN/MSQ-T11 tube development.

5. (U) Project to Completion: This is a continuing project.

6. (U) Milestones: Not Applicable.

7. (U) Resources:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total
RDT&E	<u>7,000</u>	<u>8,800</u>	<u>15,500</u>	<u>19,800</u>	<u>Continuing</u>	<u>Estimated Costs</u> <u>Not Applicable</u>

8. (U) Comparison with FY 1981 Budget Data:

RDT&E	7,000	6,800	16,100	Continuing	Not Applicable
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1236
1236

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64747F Title: Electromagnetic Radiation (EMR) Test Facilities
 DOD Mission Area: Other Test and Evaluation Support, #454 Budget Activity: Defense-Wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	TITLE	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	6,600	2,970	3,200	3,700		Not Applicable
1209	Nuclear Effects Simulation Test Facilities	5,100	1,670	1,800	2,200	Continuing	Not Applicable
2064	HAVE NOTE	1,500	1,300	1,400	1,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Nuclear weapon detonations generate electromagnetic pulses which can damage electronic components. Non-nuclear electromagnetic emissions such as jamming, may also result in component damage. The equipment malfunctions resulting from these electromagnetic environments may cause a significant reduction in weapon system effectiveness. This program element provides funds to operate and maintain test facilities and analysis capabilities to determine the ability of weapon systems to operate in nuclear (Project 1209) and non-nuclear (Project 2064) electromagnetic environments.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The requirement to test weapon system survivability in nuclear and non-nuclear electromagnetic environments is continuing. Examples of systems which are planned for testing in simulated nuclear electromagnetic pulse environments include the E-4B (Airborne Command Post), Ground Launched Cruise Missile, F-18, F-14, C-130Q, and Sea Launched Cruise Missile. Examples of systems to be analyzed in non-nuclear electromagnetic radiation environments include the Low Level Laser Guided Bomb and the High Speed High Altitude Target. The estimated costs are based on past program experience, adjustments for expected cost growth and the workload projected to support the above projects.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	6,600	3,000	3,100		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #64747F

Title: Electromagnetic Radiation (EMR) Test Facilities

DOD Mission Area: Other Test and Evaluation Support, #454

Budget Activity: Defense-Wide Mission Support #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	TITLE	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Continuing	Total Estimated Costs
1209	TOTAL FOR PROGRAM ELEMENT	6,600	2,970	3,200	3,700		Not Applicable
	Nuclear Effects Simulation	5,100	1,700	1,837	2,161	Continuing	Not Applicable
	Test Facilities						
2064	HAVE NOTE	1,500	1,300	1,400	1,500	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Nuclear weapon detonations generate electromagnetic pulses which can damage electronic components. Non-nuclear electromagnetic emissions such as jamming, may also result in component damage. The equipment malfunctions resulting from these electromagnetic environments may cause a significant reduction in weapon system effectiveness. This program element provides funds to operate and maintain test facilities and analysis capabilities to determine the ability of weapon systems to operate in nuclear (Project 1209) and non-nuclear (Project 2064) electromagnetic environments.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The requirement to test weapon system survivability in nuclear and non-nuclear electromagnetic environments is continuing. Examples of systems which are planned for testing in simulated nuclear electromagnetic pulse environments include the E-4B (Airborne Command Post), Ground Launched Cruise Missile, F-18, F-14, C-130Q, and Sea Launched Cruise Missile. Examples of systems to be analyzed in non-nuclear electromagnetic radiation environments include the Low Level Laser Guided Bomb and the High Speed High Altitude Target. The estimated costs are based on past program experience, adjustments for expected cost growth and the workload projected to support the above projects.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDTE	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Continuing	Total Estimated Costs
	6,600	3,000	3,100			Not Applicable

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

8221
1089

Program Element: #64747F

DoD Mission Area: Other Test and Evaluation Support, #454

Title: Electromagnetic Radiation (EMR) Test Facilities

Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: In Project 1209, checkout testing on TRESTLE was completed and operational testing began in March 1980 on a B-52G. Recent dipole tests have included the F-16, E-3A, E-4B, Navy C-130Q Take Charge and Move Out (TACAMO) aircraft, and Air Launched Cruise Missile. Work has also been performed in developing fiber optic sensor, building a new impulse generator for testing trailing wire antennas and improving data system software. In Project 2064, anechoic chamber improvements have been continued. A handbook for electromagnetic radiation hardening was completed and development of design standards/specifications was initiated.

2. (U) FY 1981 Program: In Project 1209, initial testing of the B-52 will be completed. Testing of the Ground Launched Cruise Missile, Navy F-14 and Sea Launched Cruise Missile is scheduled to begin. Improvements to instrumentation, data acquisition systems and pulse generators will continue. In Project 2064, testing is scheduled for the Infrared Maverick, Sidewinder (AIM-9P), and Air Launched Cruise Missile. An electrooptical/infrared targeting system will be installed in the anechoic chamber. An Automatic Data Acquisition and Control System will be developed to improved testing efficiency.

3. (U) FY 1982 Planned Program: In Project 1209, electromagnetic pulse testing of the E-4B, Ground Launched Cruise Missile and Navy C-130Q, F-14 and F-18 is scheduled. In Project 2064, testing of the High Altitude High Speed Target, Low Level Laser Guided Bomb and Laser Guided Hard Structure Munition is scheduled. Facility improvement which enhance test capabilities will continue under both projects.

4. (U) FY 1983 Planned Program: In Project 1209, electromagnetic pulse testing of the E-4B and Navy F-18 is scheduled to continue. Additional systems, including the E-3A, MX and new B-52 Offensive Avionics System will initiate testing. In Project 2064, testing will be conducted on the Advanced Medium Range Air-to-Air Missile and Wide Area Anti-Armor Munitions. Facility improvements which enhance test capabilities will continue under both projects.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

1239

Program Element: #64747F

DoD Mission Area: Other Test and Evaluation Support, #454

Title: Electromagnetic Radiation (EMR)

Test Facilities

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program is for the development, acquisition and baseline support of test facilities which simulate the nuclear and non-nuclear electromagnetic environments in which the weapon systems may be required to operate. The principal nuclear simulation facilities are the vertically and horizontally polarized electromagnetic pulse dipoles and the in-flight electromagnetic pulse simulation facility (TRESTLE). These facilities are used to test aircraft and missile systems in various operational configurations. Additional capabilities include portable electromagnetic pulse generators for remote site tests and a laboratory used for testing of individual electronic components. The non-nuclear effort provides facilities for assessing the susceptibility of weapon systems to non-nuclear electromagnetic radiation. This radiation comes from hostile or friendly sources such as radios, radars, jammers or other electronic devices. These sources can illuminate the weapon for lengthy periods of time such as when the weapon is on the aircraft approaching a target or when the weapon is enroute to the target. The principal non-nuclear test facility is the Electromagnetic Compatibility Analysis Facility, an anechoic chamber where air-launched weapons can be radiated by a variety of signals. The data collected during testing is also used to update test methods and acquisition specifications, design standards, and maintenance technical orders to insure that the weapon system is immune to those radio frequency emanations which it may encounter during its life cycle from stockpile to target. Weapon systems program offices arrange for testing time and provide test resources and test costs.

(U) RELATED ACTIVITIES: Nuclear Effects Simulator Test Facility, Project 1209, is related to Program Element 64711F, Systems Survivability (Nuclear Effects). Work performed under Program Element 64711F develops weapon system nuclear effects survivability assessment, testing and hardening techniques, while Project 1209 is directed at implementing a testing capability for one nuclear effect, electromagnetic pulse. The Air Force Weapons Laboratory is responsible for coordinating these efforts. Project 2064 (HAVE NOTE) is the Air Force implementation of the Office of the Undersecretary of Defense Research & Engineering directed Special Electromagnetic Interference Project which directs all three services to test their air-launched weapons and share test results and conclusions. Tri-service reviews are held periodically.

(U) WORK PERFORMED BY: Project 1209 is managed by Air Force Systems Command through the Air Force Weapons Laboratory, Kirtland Air Force Base, NM. Dynalectron, Washington, DC, is the facilities support contractor. Project 2064 is managed by Air Force Systems Command through the Rome Air Development Center, Griffiss Air Force Base, NY. The test support contractor is Atlantic Research Corp., Washington, D.C. Hardness criteria development for acquisition specifications and standards performed by Electrical Engineering Station, Georgia Institute of Technology, Atlanta, GA.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # 65101F

DOD Mission Area: Studies and Analyses, #440

Title: Project AIR FORCE
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
	TOTAL FOR PROGRAM ELEMENT	11,700	12,470	14,100	15,100	Continuing		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program element is devoted to assisting Air Force decision-making by furnishing information and objective findings derived from independent research and analysis of aerospace problems. The program objective is to recommend methods and techniques for consideration in the development and enhancement of aerospace power. The program funds a Federal Contract Research Center operated by The Rand Corporation.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Project AIR FORCE is a level of effort program providing improved decision-making capability for the Air Force through the creation and application of modern analytic methods. The work focuses on the future roles of air forces with emphasis on the issues which will influence decisions in the 1980's and beyond. New research efforts during FY 1982 will primarily reflect USAF interests in such issues as strategic employment and support-ability. The funding requested will provide approximately 140 man-years of professional staff support based on cost estimates made on 30 Sep 1980.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	11,700	12,500	13,500		Continuing		
Procurement: Not Applicable							

(U) OTHER APPROPRIATION FUNDS: Not Applicable

1241
1241

Program Element: # 65101F

DOD Mission Area: Studies and Analyses, #440

Title: Project AIR FORCE

Budget Activity Defense-wide Mission
Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program provides the Air Force a broad program of long-term study and research on problems in the development and employment of aerospace power. The program's continuing independent, objective and knowledgeable research contributes to the analysis and expansion of available policy, support and operational alternatives, and assists the Air Force in making better decisions on major issues. Over the years, the Air Force has implemented many suggestions from this program. Some have resulted in cost savings, some have increased existing force effectiveness, others have allowed the Air Force to seize technological opportunities, and still others have helped the Air Force to better understand the nature of future military threats and how to respond to them in a timely manner. Current research is directed toward four program areas: National Security Strategies, an area which focuses on issues of strategic policy as it relates to both major powers and third world areas, and encompasses Soviet/Chinese studies; Force Employment, which includes research on the techniques, systems, and tactics required to achieve projected military objectives; Technology Applications, an area which focuses primarily on the application of advanced technological development to military uses; and Resource Management, which addresses the means by which personnel, systems acquisition, and logistics management policies may be improved to better support the Air Force. A board of Air Force General Officers provides guidance on the overall program and sponsors new research topics as needs arise.

(U) RELATED ACTIVITIES: Project AIR FORCE studies and analyses are conducted to assist Air Force senior managers in the decision-making process. The efforts span functional and organizational boundaries and often result in broad recommendations concerning overall future Air Force actions. As a result, the research conducted under this program relates to a wide spectrum of activities in the Air Force. To assure relevance and to prevent unnecessary duplication of effort, each newly proposed research effort is reviewed by a cross-functional group of senior officers and by the Air Force Assistant Chief of Staff for Studies and Analyses; in addition, the results are published and deposited with the Defense Technical Information Center.

(U) WORK PERFORMED BY: The Director of Operational Requirements, DCS/Research, Development and Acquisition, Headquarters USAF, is the Executive Agent and is responsible for the administration of the Project. All work is performed by The Rand Corporation, Santa Monica, California.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The FY 1980 and prior year programs included: (1) National Security Strategies: Rand produced several studies oriented toward the strategic balance between the Soviet Union and The United States and the analysis of the key elements in that balance. This research effort included studies focusing on the Middle East and Persian Gulf regions, a quantitative analysis of U.S. anti-satellite requirements, and several efforts to analyze both our own and Soviet long-range planning and policy processes. (2) Force Employment: Several efforts to improve the Air Force capability in ground attack, especially against Warsaw Pact units, an assessment of the effectiveness of tactical command and control of air units, a study of battle management of cruise missiles, and a simulation of strategic battle for use by the Strategic Air Command were produced. (3) Technology Applications: Several analyses were made of space-based technologies and how they can be used to improve command, control, communications, and surveillance; a study of the primary issues involved in the space shuttle program and an evaluation of decision-making and information processing in command and control were accomplished; and support was obtained for DOD hypersonic re-entry vehicle programs.

Program Element: # 65101F

DOD Mission Area: Studies and Analyses, #440

Title: Project AIR FORCE

Budget Activity: Defense-wide Mission Support, #6

(4) Resource Management: Research in war reserve materiel, improved sortie production in wartime environments, and intra-theater transportation systems was conducted. In addition, studies were conducted on co-national acquisition, military communications satellite acquisition, and aircraft acquisition policy. Also in this area, studies were made in such issues as enlisted force management, officer personnel management, substance abuse programs, and Air Force health care programs.

2. (U) FY 1981 Program: Accomplishments are anticipated in the following program areas: (1) National Security Strategies Program. Research is expected to identify different alternative future environments that lead to conflict; formulate a set of distinct national security strategies and evaluate their probable performance in the alternative environments; determine the implications of these evaluations for the use of military force; identify the appropriate military capabilities, budgetary implications, and risks associated with these capabilities. (2) Force Employment Program. The tentative goal of this relatively new program is to provide study results on the enhancement of the capability of current and forthcoming USAF assets, focusing on the numerous force, munition, and basing options available, and on the issues surrounding the measurement of force effectiveness. (3) Technology Applications Program. This research will include the examination of technical feasibility, appropriate hardware configuration, and estimated mission effectiveness of advanced technologies that have substantial potential benefit to the Air Force. Rand will recommend the key development activities required to achieve needed capabilities. (4) Resource Management Program. This research will provide an integrated concept of resource management with which to identify, achieve, and assess alternative combinations of resources-personnel military hardware and material (including weapon systems, spare parts, support equipment, and consumables), and facilities--necessary for the effective and efficient conduct of Air Force missions.

3. (U) FY 1982 Planned Program: The emphasis will be on broad, long-term issues and problem areas that are of top priority to the upper levels of Air Force management. The research conducted will be cross-functional and will be inter-related among the four major program areas. Specific study subjects will derive from the FY 81 program and from the priorities established by the board of general officers which directs and controls the program. The expectation is that the program will continue to focus on strategic issues and the management policies necessary to deploy and sustain a strategic force. The funding difference between this year's and last year's FY 1982 planned program is an inflation adjustment; however, the total contract level of effort has declined during the past year due to inflationary effects.

4. (U) FY 1983 Planned Program: The program will evolve as for FY 1981 under careful planning by the Air Force Advisory Group. Only projects which are not duplicated elsewhere and are strongly needed by the Air Force will be included. They must require the objectivity and independence of Project AIR FORCE.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

1139 12442
12442

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65304F

Title: Acquisition and Command Support
Telecommunications and General Support
Budget Activity: Defense-wide Mission
Support, #6

DOD Mission Area: General Management Support, #471

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
<u>TOTAL FOR PROGRAM ELEMENT</u>							
		4,127	4,350	4,800	5,300		

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Provides essential communications services to: Headquarters, Air Force Systems Command (AFSC); Aerospace Medical Division; Aeronautical Systems Division; Electronic Systems Division (ESD); Space Division (SD); and the Ballistic Missile Office.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This is a continuing program which provides the following: switchboards at ESD and SD; local tielines; equipment rentals; mobile radios for command/disaster control/security policy; and official toll calls, AFSC postage and printing charges. The use of approved inflation indices and additional communication requirements for the new Systems Management Engineering Facility (FY 1980 Military Construction Program of Hanscom AFB, Mass) form the basis for this cost estimate.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs Not Applicable
	3,900	4,400	5,000			

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

1245
1245

Program Element: # 65304F

DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support
Telecommunications and General Support
Budget Activity: Defense-wide Mission
Support #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element provides communication support to Air Force Systems Command (AFSC), Aerospace Medical Division, Aeronautical Systems Division (ASD), Electronic Systems Division (ESD), and the Space Division (SD), and the Ballistic Missile Office. It includes:

(U) The base communications administrative switchboards at ESD and SD; local tielines into commercial systems; recurring charges including associated equipment rentals, main telephone lines, extension telephones, and key systems; and dedicated support to the AFSC Advanced Management and Information System and AFSC Network.

(U) Command and control voice network and administrative tielines circuits between HQ AFSC, Divisions, Centers, and Ranges; circuits between SD and the National Ranges used to transmit launch information from the ranges to the program offices; and the telephone lines required to support the program offices.

(U) Funds to lease/maintain nontactical radios for command/disaster control/Civil Engineering/security and maintenance expediter nets at ASD and SD.

(U) Official tolls, Wide Area Telephone Service, and message unit charges for local calls from the bases to surrounding civilian communities. There are no free calls off stations.

(U) AFSC postage and printing charges.

(U) RELATED ACTIVITIES: This program element is in direct support of the Acquisition and Command Support, Program Element 65806F.

(U) WORK PERFORMED BY: American Telephone Company, New York, NY; RCA Corporation, New York, NY; Western Union Corporation, Mohwah, NJ; New England Telephone and Telegraph Company, Boston, MA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This is a continuing program.

2. (U) FY 1981 Program: This program continues funding for leased communication lines, switchboards and associated equipment required to carry-out the AFSC mission. Other requirements include: non-tactical radios, AFSC postage and franked envelope printing charges, and sustain implementation of the Advanced Management and Information System and AFSC network systems.

Program Element: #65304F

Title: Acquisition and Command Support

Telecommunications and General Support

DOD Mission Area: General Management Support, #471

Budget Activity: Defense-wide Mission

Support, #6

3. (U) FY 1982 Planned Program: Provides funding for continuation of communication support to Air Force Systems Command (AFSC) and its divisions and offices. While deletion of some circuits and addition of others will occur, requirement increase is for allowance for escalation due to inflation and the new Systems Management Engineering Facility at Hanscom AFB, MA.

4. (U) FY 1983 Planned Program: Provides funding for continuing operation, maintenance, and leased costs of circuits and communications services.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestone: Not Applicable.

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12479 B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65306F

Title: Environmental Epidemiology

DOD Mission Area: Environmental and Life Sciences (ATD), #552

Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Program to Completion
TOTAL FOR PROGRAM ELEMENT							
2767	Epidemiological Study of Ranch Hand Personnel		1,800	4,000	4,600	Continuing	Not Applicable
			1,800	4,000	4,600	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The study is required to determine long-term health effects of exposure to Air Force (Ranch Hand) personnel and veterans to Herbicide Orange in Vietnam. This program has been directed by the White House through a 16 September 1980 memo from Mr. Eizenstat, Assistant to the President for Domestic Affairs and Policy, to Secretary Brown. The Air Force Ranch Hand personnel are the only population whose frequency and duration of exposure to the herbicide are known with any accuracy.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The Department of Defense directed that this program be funded from research, development, testing and evaluation appropriations rather than operations and maintenance appropriations. Therefore, this study is considered a new start in research, development, testing and evaluation. This is a continuing program with a potential 20-year commitment. Reviews will occur after the completion of the initial physical examination and questionnaire administration to determine if the study results and participation justify continuing the study. Additional reviews will occur at 5-year points. Cost estimates were developed by taking each segment of the study (Project Management, Mortality Study, Questionnaire Development and Administration, Physical Examinations and the Data Base Management System) and projecting requirements based on many reviews at all levels of command.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: Not applicable. New research, development, testing and evaluation start.

(U) OTHER APPROPRIATION FUNDS:

Operation and Maintenance

382

This program was initiated with operations and maintenance funds in FY 1980, but was transferred to research, development and evaluation funds in FY 1981.

1143

1247

1249

Program Element: #65306F

DOD Mission Area: Supporting Base Research and Development, #322

Title: Environmental Epidemiology

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Air Force has made the commitment to Congress and to the White House to conduct an epidemiological study of possible health effects on Air Force personnel (Ranch Hand) who conducted aerial herbicide missions in Vietnam. The purpose of this investigation is to determine whether long-term health effects exist and can be attributed to occupational exposure to Herbicide Orange. The extensive use of herbicides in Vietnam between 1962 and 1970 was terminated when it became known that a contaminant, tetrachlorodibenzo-P-dioxin (dioxin), was present in the herbicides and that this contaminant caused congenital abnormalities when administered to pregnant rodents. Subsequent extensive research into the toxicity of dioxin in animals remains equivocal. The scientific literature on the toxicity of the components of Herbicide Orange reveals that the two main ingredients have extremely low toxicity, distinctly different than dioxin. Dioxin has been shown to be embryotoxic at markedly lower doses in animals. Only recently have comprehensive prospective studies in humans been undertaken. Most previous epidemiological studies dealing with dioxin exposure in humans have suffered from weaknesses in design, statistical power and references. These studies have only validated a link between dioxin exposure and the subsequent development of a minor skin disease. The public's perception of the toxicity of Herbicide Orange/dioxin is generally different than that of the scientific community. A review of over 500 veteran's claims submitted to the Veterans Administration supports this fact and reveals that Ranch Hand personnel were potentially at greatest risk; therefore, an epidemiological investigation of these personnel will be conducted to attempt to elicit any adverse health effects from their exposure. This is potentially a 20-year program involving a comparison of Ranch Hand personnel to other crew members and support personnel serving in Vietnam, who were not exposed to herbicides for mortality rates, present and past health status, and future follow-up health status at 3-, 5-, 10-, 15- and 20-year time periods.

(U) RELATED ACTIVITIES: This is only one of several Federal studies designed to provide information regarding alleged claims of adverse health effects from Vietnam veterans exposed to Herbicide Orange. These studies, including the Air Force study and the birth defects study to determine the effects of Herbicide Orange conducted by the Center for Disease Control, are being coordinated by an Interagency Working Group, established by the White House, which has program review authority and could require certain changes that would impact funding, scheduling or both.

(U) WORK PERFORMED BY: This program is being conducted by the Aerospace Medical Division through the United States Air Force School of Aerospace Medicine, Brooks Air Force Base, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAM:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: Although the Herbicide Orange epidemiology study is considered a new research, development, test and evaluation effort, the program was progressing through the use of operation and maintenance funds. The study protocol was established, the study population ascertainment effort was completed, matching the control group with the exposed group was initiated and the baseline mortality study was started.

Program Element: #65306F

DOD Mission Area: Supporting Base Research and Development, #322

Title: Environmental Epidemiology
Budget Activity: Defense-wide Mission Support, #6

2. (U) FY 1981 PLANNED PROGRAM: The program includes completion of the population matching, questionnaire development, pretest of the questionnaire, start questionnaire administration, start of physical examinations, continuing the mortality study and the data base management system.

3. (U) FY 1982 PLANNED PROGRAM: The planned program includes data acquisition and analysis of questionnaire results, continuation of the physical examinations and analysis of examination data, adaptive changes to the questionnaire/physical examination as required, and continuation of the mortality study and data base management system.

4. (U) FY 1983 PLANNED PROGRAM: This FY will continue project management, mortality study, adaptive changes to the questionnaire and physical examinations and the data base management system.

5. (U) PROGRAM TO COMPLETION: This is a continuing program with follow-up health status and mortality rate determinations at the 3-, 5-, 10-, 15-, and 20-year time periods. Data analysis and adaptive changes to questionnaire or physical exam will occur in the intervening time periods.

6. (U) MILESTONES: Not applicable.

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1251B

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: # #65806F

DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	227,509	228,552	260,900	267,000	Continuing	Not Applicable
	Hq, Air Force Systems Command* (AFSC) Support Activities	11,750	12,683	14,417	14,480	Continuing	Not Applicable
	Aeronautical Systems Division (ASD)	98,536	96,218	104,891	106,955	Continuing	Not Applicable
	Electronic Systems Division (ESD)	53,425	51,914	58,467	60,825	Continuing	Not Applicable
	Aerospace Medical Division (AMD)	12,620	13,367	14,483	14,535	Continuing	Not Applicable
	Space Division (SD)	33,014	34,963	38,740	39,970	Continuing	Not Applicable
	Armament Division (AD)	11,786	12,129	21,942	22,190	Continuing	Not Applicable
	Ballistic Missile Office (BMO)	6,378	7,278	7,960	8,045	Continuing	Not Applicable

*Funding for Headquarters Air Force Systems Command is shown in Program Element (PE) 65898F (Management Headquarters - Research and Development).

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: Acquisition and Command Support (ACS) provides the resources to support the commander, his staff, the technical mission, and support functions at each of the organizations listed above. Categories of cost include pay and the related costs of civilian personnel, travel, transportation, rents, utilities, contractual services, supplies, and equipment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program provides the resources to support the commander, his staff, the technical mission, and support function of each of the organizations listed above. FY 1982 funding is increased by 15.0 million over the appropriated level to insure minimum level support in FY 1982, including the annualization of the 1 October 1980 civilian pay raise, and repricing of non-personnel support costs due to inflation, including the 1980 POL price increases and its impact on utilities and transportation expenses. OSD directed a realignment of funding at Armament Division as a result of the redesignation of AD from a Test Center to a Division. This resulted in transferring the AD commander and various staff elements not directly associated with a Test and Evaluation mission from PE 65807F to PE 65806F effective in FY 1982.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 83 Estimate	Additional to Completion	Total Estimated Cost
RDT&E	211,364	230,000	237,600		Continuing	Not Applicable

OTHER APPROPRIATION FUNDS:

Military Construction

9,010

4,200

Continuing Not Applicable

1146

1253

Program Element: #65806F

DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element provides the resources to support the commander, his staff, the technical mission and base support functions of Aeronautical Systems Division, Electronic Systems Division, Aerospace Medical Division, Space Division, Ballistic Missile Office, and the Armament System Program Offices of the Armament Development Test Center, Eglin AFB, FL. Starting in FY 1979 the Procurement and Plans Offices of ADTC Armament Systems Program Offices were transferred into this program element from Program Element 65807F (Test and Evaluation Support) as a result of a management engineering team survey. In FY 1978, the transfer of Headquarters Air Force Systems Command (HQ AFSC) and the 6590th Support Squadron to PE 65898F (Management Headquarters Research and Development was accomplished.

(U) RELATED ACTIVITIES: This program supports nearly all Air Force RDT&E program elements and the procurement programs assigned to AFSC. Communication support for this element is in PE 65304F (Acquisition and Command Support Telecommunications and General Support). Management activities by Headquarters AFSC are supported in PE 65898F (Management Headquarters - R&D).

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH, - responsible for management of aeronautic systems acquisition. Electronic Systems Division, L.G. Hanscom AFB, MA - responsible for command, control, and communications systems. Aerospace Medical Division, Brooks AFB, TX - provides biomedical support for aerospace systems. Space Division, Los Angeles AFB, CA - plans programs, and manages space systems. Armament Systems Program Offices, Armament Division, Eglin AFB, FL - manages the validation, development, and production of nonnuclear air armament systems, Ballistic Missile Office, Norton AFB, CA - plans, programs, and manages the DoD ballistic missile programs. HQ AFSC Activities, various locations - provide support to HQ AFSC.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable

2. (U) FY 1981 Program: This an in-house effort by the organizations cited above which support many program elements and projects in the Research Development, Test and Evaluation community, and procurement of weapon, space, missile and avionic systems.

3. (U) FY 1982 Planned Program: The main cost of this program is for pay of personnel. Seventy-five percent of the total is for pay of personnel. FY 1982 reflects an increase above the FY 1981 Budget Submission because of Congressional approved inflation for Petroleum Oil and Lube (POL) and the associated impact on other areas of expense. The largest increase, however, is due to the annualization of the 1 October 1980 civilian pay raise.

1254
1254

Program Element: #65806F

DOD Mission Area: General Management Support, #471

Title: Acquisition and Command Support

Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1983 Planned Program: Major changes are foreseen in the nature of this element for support of the Space Transportation System, Space Defense System, and Missile-X program.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

Project: Not Applicable

Program Element: # 65806F

DOD Mission Area: General Management Support, #471

Title: Headquarters Air Force Systems Command

(AFSC) Support Activity

Title: Acquisition and Command Support

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The mission of AFSC is to advance aerospace science and technology, apply it to aerospace systems development and improvement, and acquire qualitatively superior aerospace systems and equipment needed to accomplish the Air Force mission. The following organizations funded from this program element provide support to the AFSC: 6591st Computer Services Squadron, provides data automation services to HQ AFSC; 6592nd Management Engineering Squadron, provides AFSC field commands base level manpower and organization services to include developing and maintaining manpower standards; 6593rd Field Printing Squadron provides composition, lithograph, duplicating, printing and bindery services for HQ AFSC, and other units. This program funds for pay and related costs of civilian personnel, travel, transportation, rents, contractual services, supplies, and equipment.

(U) RELATED ACTIVITIES: This program element directly supports HQ AFSC's management headquarters which is funded from Program Element 65898F (Management and Headquarters - Research and Development). Communication Support is funded in Program Element 65304F (ACS Telecommunications and General Support).

(U) WORK PERFORMED BY: Major contracts include: Honeywell Corporation, McLean, VA, for automatic data processing equipment rental; Xerox Corporation, Arlington, VA, for lease of reproduction equipment.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable.

2. (U) FY 1981 Program: This is an in-house effort by the organizations cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

3. (U) FY 1982 Planned Program: This is a level of effort program, the main cost of which is for pay of personnel. 75 percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

4. (U) FY 1983 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Milestones: Not applicable.

6. (U) Milestones: Not applicable

7. (U) Resources: (\$ in thousands)

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated Cost
					Continuing	Not Applicable
	11,750	12,683	14,417	14,480		

RDT&E:*

* Excludes reimbursements

1160

(1256) 256

Project: Not Applicable

Program Element: #65806F

DOD Mission Area: General Management Support, #471

Title: Headquarters Air Force Systems Command
(AFSC) Support Activity

Title: Acquisition and Command Support
Budget Activity: Defense-wide Mission Support, #6

8. (U) Comparison with FY 1981 Budget Data:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost	Not Applicable
RD1&E *	11,815	13,050	13,480		Continuing		

*Excludes reimbursements

Project: Not Applicable
Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Aeronautical Systems Division (ASD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: ASD manages acquisition of aeronautical systems, subsystems, and related equipment programs and projects until transfer of responsibility to Air Force Logistics Command (AFLC); accomplishes systems engineering and technical direction to designated programs and provides general engineering support in applicable disciplines; exercises overall responsibility for development Test and Evaluation for assigned advanced and engineering development; and exploits exploratory and advanced development products, including foreign technology, ASD has responsibility for approximately 27 Program Offices, including major programs such as the F-16, F-15, A-10, and Strategic Systems; and has project office responsibility for numerous system projects.

(U) RELATED ACTIVITIES: ASD establishes technology needs with the Air Force Systems Command (AFSC) laboratories for exploratory and advanced development required to satisfy new capabilities or eliminate deficiencies; provides engineering support to AFLC; ensures, in collaboration with AFLC, that logistic support considerations are an integral part of systems, subsystems, and equipment acquisition; performs flight tests and related modifications in support of ASD and AFSC laboratories/projects in the exploratory and advanced development areas of propulsion avionics, flight dynamics, weightlessness, electronic warfare, life support systems, and materials; furnishes flight test support to the Department of Defense (DoD) agencies, National Aeronautics and Space Administration (NASA), and Federal Aviation Administration (FAA) as directed; manages the International, DoD, Air Force, and AFSC engineering standardization programs in support of ASD, AFSC laboratories, and AFSC divisions, evaluates and applies intelligence provided by Foreign Technology Division (FTD) which is relevant to ASD development and production programs and projects; and manages all phases of procurement and production including management of government-owned industrial facilities, systems, Research and Development, services, material transportation, supplies, and support as delegated by HQ AFSC. Related Program Elements are: 65304F, ACS Telecommunications and General Support; and 65807F, Test and Evaluation Support, which finances the 4950th Test Wing activities.

(U) WORK PERFORMED BY: Aeronautical Systems Division, Wright-Patterson AFB, OH. Major contractors include: Synergy Inc. Enon, OH, provides computer operators; Systems Research Laboratories, Dayton, OH, provides computer maintenance; Control Data Corp, Minneapolis, NM, provides computer rentals and support; Burroughs Corp, Paoli, PA, provides computer rental; Xerox Corp., Rochester NY, provides reproduction equipment; and 230 other contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable
2. (U) FY 1981 Program: This is an in-house effort by the organization cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

(1219) 258

Project: Not Applicable
Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Aeronautical Systems Division (ASD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

3. (U) FY 1982 Planned Program: This is a continuing program, the main cost of which is for pay of personnel. eighty-six percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

4. (U) FY 1983 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) Resources: (\$ in thousands)

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
						Cost
RD&E*	98,536	96,218	104,891	106,955	Continuing	Not Applicable

8. (U) Comparison With FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional	Total
	Estimate	Estimate	Estimate	Estimate	to Completion	Estimated
						Cost
RD&E*	92,005	97,767	100,769		Continuing	Not Applicable

*Excludes Reimbursements

1152
1259
1259

Project: Not Applicable

Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Electronic Systems Division (ESD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: ESD plans and manages the acquisition and related engineering development of command, control and communications, and intelligence electronic systems, subsystems, and equipment; plans and conducts research and exploratory and advanced development programs in areas of information sciences, intelligence for command, control and communications; accomplishes assigned engineering development; exploits exploratory and advanced development products, including foreign technology; manages the operations of the Electromagnetic Compatibility Analysis Center; and manages assigned Foreign Military Sales programs. ESD has responsibility for approximately 25 Program Offices and major programs such as Traffic Control Approach and Landing System, Tactical Information Processing and Interpretation System, Airborne Warning and Control System, Over the Horizon Radars, Advanced Airborne Command Post, and Tactical Long Range Navigation. ESD also has project office responsibility for over 100 projects.

(U) RELATED ACTIVITIES: The ESD establishes technology needs with the Air Force Systems Command laboratories for exploratory and advanced development required to satisfy new capabilities or eliminate deficiencies; renders assistance to Headquarters United States Air Force in preparation of automatic data processing equipment specifications; acts as contracting agent for MITRE support to the Department of Defense; monitors and controls MITRE support to the Air Force; acquires, analyzes, evaluates, and applies intelligence relevant to ESD acquisition programs and projects; and contributes results of intelligence analysis and evaluations to AFSC intelligence projects. A related Program Element is 65304F, ACS Telecommunications and General Support.

(U) WORK PERFORMED BY: Electronic Systems Division, Hanscom AFB, MA. Major contractors include: Multi-Service Maintenance, Boston, MA; Arpin Van Lines, Providence, RI; Miller Disposal Inc., Boston, MA; Charles Bank Laundry, Cambridge, MA; Parkway Inc., Tewksbury, MA., Service Filter Co., Boston, MA; Univac Corp., Boston, MA; Booz Allan and Hamilton, Boston, MA; and 65 other contractors.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable
2. (U) FY 1981 Program: This is an in-house effort by the organizations cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.
3. (U) FY 1982 Planned Program: This is a level of effort program, the main cost of which is for pay of personnel. 73 percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.

Project: Not Applicable

Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Electronic Systems Division (ESD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1983 Planned Program: No major changes are foreseen in the nature of this element at this time.

5. (U) Program to Completion: This is a continuuig program.

6. (U) Milestone: Not applicable

7. (U) Resources: (\$ in thousands)

<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to</u>	<u>Estimated</u>
				<u>Completion</u>	<u>Cost</u>
53,425	51,914	58,467	60,825	Continuing	Not Applicable

RDTE*

8. (U) Comparison With FY 1981 Budget Data:

<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to</u>	<u>Estimated</u>
				<u>Completion</u>	<u>Cost</u>
48,447	52,373	54,101		Continuing	Not Applicable

RDTE*

*Excludes Reimbursements

Project: Not Applicable
Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Aerospace Medical Division (AMD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The AMD plans and executes the Air Force Systems Command (AFSC) exploratory, advanced, and engineering development programs to provide biomedical support for aerospace systems; advanced aerospace biotechnology; determines the personnel hazards of aerospace environments and establishes human tolerance to them; extends human capabilities and enhances integration of man in weapon systems, provides biomedical support for the personnel subsystems; improves Air Force health services; and provides technical or management assistance in these areas to support studies analysis development planning acquisition, test, evaluation, modification or operation of aerospace systems and related equipment. Specifically, the AMD: provides the principal Air Force interface with scientific, industry, educational, and government agencies and acts as AFSC focal point in the areas of AMD technical responsibility; executes assigned projects for and works closely with other major commands, Army, Navy, Defense Advanced Research Projects Agency, National Aeronautics and Space Administration, Defense Nuclear Agency, Health, Education and Welfare, and other government agencies; supports foreign aerospace technology activities as provided in the Consolidation Intelligence Program; maintains a competent and comprehensive in-house research, development, test, and evaluation capability; conducts research and development to sustain and effectively use man in aerospace and ground operational environments; plans and conducts educational programs including graduate level courses, aerospace, and clinical medicine and related subjects; provides base health services for the Lackland Military Training Center; and provides the focal point with the Command and government-owned, contractor operated chambers under the jurisdiction of AFSC. AMD's 6570th Air Base Group operates and maintains Brooks AFB and provides support to AMD's Air Force School of Aerospace Medicine and Wilford Hall United States Air Force Medical Center. Support is also provided to the Headquarters, Air Force Human Resources Laboratory, the United States Air Force Occupational and Environmental Health Laboratory, HQ USAF Medical Service Center, and the 6906 Electronic Security Squadron.

(U) RELATED ACTIVITIES: AMD related activities are Aerospace Biotechnology (PE 62202F), Personnel Utilization Technology (PE 62703F) Satellite Control Facility (PE 35110F), Other Health Activities (PE 87714F), and ACS Telecommunications and General (PE 65304F); PE 86761F, Education and Training - Health Care; PE 87711F Care in Regional Facilities; PE 87794 - Real Property Maintenance Activities - Health Care; PE 87795F Communications Health Care; PE 89732F - Off Duty and Volunteer Education Programs; PE 27593F Chemical Biological Defense; PE 91515F - Official representation; PE 88716F - Other Personnel Activities, PE 87792F - Medical Clinics, PE 87715F - Dental Care Activities.

(U) WORK PERFORMED BY: Aerospace Medical Division Brooks AFB, TX. Major contracts include: What-Mac Contractors Inc., San Antonio, TX; DIV Laundry Dry Cleaning, San Antonio, TX; and San Antonio Real Property Maintenance Agency (SARPM), Service Masters Industries, Inc, Downers Grove, IL.

Project: Not Applicable

Program Element: #65806P

DOD Mission Area: General Management Support #471

Title: Aerospace Medical Division (AMD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.
2. (U) FY 1981 Program: This is an in-house effort by the organization cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.
3. (U) FY 1982 Planned Program: This is a level of effort program, the main cost of which is for pay of personnel. 26 percent of the total is for pay of personnel. The cost increase from last year's Budget Submission is explained in the program element descriptive summary.
4. (U) FY 1983 Planned Program: No major changes are foreseen in the nature of this element at this time.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.
7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u> <u>to</u> <u>Completion</u>	<u>Total</u> <u>Estimated</u> <u>Cost</u>
RDTE*	12,620	13,367	14,483	14,535	Continuing	Not Applicable

8. (U) Comparison With FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u> <u>to</u> <u>Completion</u>	<u>Total</u> <u>Estimated</u> <u>Cost</u>
RDTE*	12,461	13,370	14,015		Continuing	Not Applicable

*Excludes Reimbursements

Project: Not Applicable

Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Space Division (SD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: SD plans, programs, and manages systems programs to acquire space and missile systems, Aerospace Ground Equipment, and other subsystems and related hardware; provides for the activation and alteration of ground launch facilities; performs the functions of launch, on-orbit tracking, data acquisition, and command and control of Department of Defense (DoD) satellites; and affects recovery of various space packages. Conducts and manages standardization programs, medical activities, bioenvironmental engineering, system safety engineering, electromagnetic compatibility, personnel subsystems, reliability and maintainability, configuration management, survivability and vulnerability, systems engineering, value engineering, and quality assurance programs related to space and missile systems, equipment and material. Acquires and manages industrial facilities. Prepares, completes, and coordinates program management plans, to include management arrangements with other elements of Air Force Systems Command, United States Air Force, DoD agencies, military departments, Government agencies, and industry. Supports and participates in Research and Development and procurement and production programs established with North Atlantic Treaty Organization, and other friendly international organizations or individual nations. Ensures efficient and effective logistic support of systems and equipment being developed for operational inventory and manages all phases of material, transportation, transportability, supplies, maintenance, Aerospace Ground Equipment, and propellants, in support of all SD programs and projects. Furnishes staff medical support and operates a Class B Dispensary. Provides, in collaboration with the Aerospace Medical Division, medical surveillance of systems development to ensure that medical research and support requirements are determined concurrently with system development. Discharges USAF responsibilities as Manager of the DoD Space Test Program. Provide required functional assistance to the Director of Special Projects, Headquarters USAF. SD has responsibility for System Program offices, including Space Boosters & Space Transportation Program, Defense Dissemination Program, Satellite Data Systems, and has project office responsibility for approximately 40 projects including executive responsibility for the Global Positioning Satellite Joint Program. Two major sub-elements of SD, the Air Force Satellite Control Facility and the Space and Missile Test Organization are funded as independent program elements: Program Element 35110F, and Program Element 78032F, respectively.

(U) RELATED ACTIVITIES: SD uses the capabilities of the Air Force laboratories, centers, ranges and other AFSC in-house capabilities to the maximum extent feasible in all phases of systems planning, development, acquisition, and test. SD provides assistance to AFSC lead laboratories in the review and evaluation of those industry Independent Research and Development programs related to Air Force space and missile systems, subsystems, and equipment, and acts as lead AFSC organization for contractors assigned by Headquarters AFSC. Related Program Elements are: 35110F, Satellite Control Facility; 65304F, Acquisition and Command Support (ACS) Telecommunications and General Support; 78032F, Western Test Range; and 78022F, Eastern Test Range.

Project: Not Applicable

Program Element: #65806P

DOD Mission Area: General Management Support #471

Title: Space Division (SD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) WORK PERFORMED BY: Space Division Los Angeles Air Force Station, CA. Major contractors include: Trend Western Technical Corp, Los Angeles, Ca; SP&P Inc., Anaheim, CA; B&W Services Industries, Los Angeles, CA; Del-Jen, Los Angeles, CA., Burroughs Corp., Paoli, PA., Xerox, Torrance, CA; Ontel Corp., Plainview, NY; Proprietary Computer Systems, Van Nuys, CA; Action Transfer Centers, Gardena, CA; Washington Patrol Services, Inc, Escondido, CA; Quinttron Systems, Santa Maria, CA. There are no other major contracts at SD funded by this program element.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable
2. (U) FY 1981 Program: This is an in-house effort by the organization cited above which support many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.
3. (U) FY 1982 Planned Program: This is a continuing program, the main cost of which is for pay of personnel. 61 percent of the total is for pay of personnel. FY 1981/FY 1982 program effort increases due to the Space Transportation (STS) and Space Defense System (SDS).
4. (U) FY 1983 Planned Program: No major changes are foreseen in the nature of this element at this time.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.
7. (U) Resources: (\$ in thousands)

RDT&E*

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	33,014	34,963	38,740	39,970	Continuing	Not Applicable

8. (U) Comparison With FY 1981 Budget Submission:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
	31,208	34,892	36,043		Continuing	Not Applicable

RDT&E*

*Excludes Reimbursements.

1150

1265

Project: Not Applicable
Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Armament Division (AD)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Deputy for Armament Systems at the Armament Division (AD), Eglin AFB FL, manages for the Air Force the validation, development and production of air armaments; is responsible for the development, test, evaluation, and logistic support of the Sidewinder (AIM-9L), Sparrow III (AIM-7F), SHRIKE (ACM-45B) and the Anti-Radiation Missile (ACM-88, B/C/D), and advanced medium range air-to-air missile systems, on a joint service basis to satisfy Air Force needs; is responsible for the development, test, evaluation and logistics for dispensers, rockets, flares, fuzes and other nonnuclear munitions and related support equipment, range instrumentation and tactical training support equipment, improved capability for Operational Test and Evaluation, Chemical/Biological defense equipment, improved Air Combat Fighter gun systems, and foreign weapons evaluation; provides armament system program technical direction to contractors; establish systems program financial objectives and cost control management; manage the acquisition of all subsystems; and incorporate new or advanced technology through modification of system hardware. The Deputy for Development Plans manages all air armament systems conceptual phase programs; is responsible for the Air Force Systems Command Program Plan, Nonnuclear Armament Plan, and prepares and updates the Air Force Nonnuclear Consumable Annual Analysis attrition data base. The Deputy is the International Systems Focal Point and manages the Foreign Weapons Evaluation Program. Development Plans formulates the Product Division Workload Forecast, provides technology guidance to the Laboratories, establishes cadre Systems Procurement Offices as necessary, performs engineering and effectiveness studies and acts as division manager for using command requirements documents.

(U) RELATED ACTIVITIES: The Deputy for Armament Systems and the Deputy for Development Plans uses the capabilities of the Air Force Laboratories, test centers, ranges, and other Air Force Systems Command in-house capabilities to the maximum extent feasible in all phases of systems planning, development, acquisition and test. AD/Systems Division functions as AD focal point on all actions cognizant to the Joint Conventional Ammunition Program Group and single manager for conventional munitions activities. Related program elements are PE 27162F - Tactical Air-to-Ground Missiles; PE 35116F - Aerial Target Drones; PE 63232F - Advanced Aerial Targets Technology; PE 64602F - Armament/ Ordnance Development; PE 64610F - Air Delivered Land Mines; PE 64733F - Surface Defense Suppression; PE 27161F - Tactical Intercept Missiles; PE 63741F - Defense Suppression; PE 27429F - Range Improvement Equipment; PE 27597F - Tactical Training Support Equipment; PE 64735F - Improved Capability for OT&E; PE 11897F - Training Support Equipment; PE 64601F C/B Defense Equipment; PE 64603F - Improved ACP Gun Systems; PE 63316F - Advanced Air-to-Air Missile System; PE 64604F - Low Altitude Airfield Attack Systems; PE 63370F and PE 64314F - AMRAM; PE 63609F - Advanced Attack Weapons; PE 64607F - WAAM; PE 64211F - Advanced Aerial Targets Development, and PE 28030F - WRM Munitions. AD/XR functions as AD focal point for systems requirements, Division Advisory Group and Scientific Advisory Board (SAB) activities and International Programs Focal Point. Related program elements are PE 63101F - Development Planning, PE 63306F - Defense Suppression Weapons Advanced Technology, PE 63380F - Advanced Short Range Air-to-Air Missile (ASRAAM), PE 64302F - Defense Suppression Weapons Engineering Development, PE 63609F - Advanced Attack Weapons, PE 64614F - Advanced Conventional Standoff Missile, and PE 64615F - Guided Hard Structure Munitions.

Project: Not Applicable

Program Element: #65806P

DOD Mission Area: General Management Support #471

Title: Armament System Program Offices

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) WORK PERFORMED BY: The Deputy for Armament Systems, Deputy for Development Plans, and a part of the Deputy for Contract and Manufacturing, and the Deputy for Comptroller, Eglin AFB FL. There are no contracts funded in this project.

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Discussed in individual RDT&E program elements managed by AD.
2. (U) FY 1981 Program: Discussed in individual RDT&E program elements by AD. Man-years and funding are increased to accommodate personnel in the procurement and plans offices previously funded in PE 65807F, Test and Evaluation Support.
3. (U) FY 1982 Planned Program: OSD directed a realignment of funding at AD as a result of the resignation of AD from a Test Center to a Division. This resulted in transferring the AD commander and various staff elements not directly associated with a Test and Evaluation mission from PE 65807F to PE 65806P effective in FY 1982. 87 percent is for pay of personnel.

4. (U) FY 1983 Planned Program: This continues the FY 1982 level of effort.

5. (U) Program to Completion: This is a continuing programs.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
RDT&E*	11,786	12,129	21,942	22,190	Continuing	Not Applicable
(U) Comparison With FY 1981 Budget Data:					Additional to Completion	Total Estimated Cost
	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate		
	10,428	11,048	11,445		Continuing	Not Applicable

*Excludes Reimbursements

Project: Not Applicable

Program Element: #65806F

DOD Mission Area: General Management Support #471

Title: Ballistic Missile Office (BMO)

Title: Acquisition and Command Support (ACS)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: BMO Plans, programs, and manages systems programs to acquire ballistic missile systems, Aerospace Ground Equipment, and other subsystems and related hardware; provides for the activation/ alteration of missile sites and ground launch facilities. Conducts and manages standardization programs, medical activities, bio-environmental engineering, system safety engineering, electromagnetic compatibility, personnel subsystems, reliability and maintainability, configuration management, survivability and vulnerability, systems engineering, value engineering, and quality assurance programs, related to missile systems, equipment and material. Acquires and manages industrial facilities. Prepares, completes, and coordinates program management plans, to include management arrangements with other elements of Air Force Systems Command, United States Air Force, Department of Defense agencies, military department Government agencies and industry. Supports and participates in Research and Development and procurement and production programs established with North Atlantic Treaty Organization, and other friendly international organizations or individual nations. Ensures efficient and effective logistic support of systems and equipment being developed for the operational inventory and manages all phases of material, transportation, transportability, supplies, maintenance, Aerospace Ground Equipment, and propellents, in support of all BMO programs and projects. Discharges USAF responsibility as Manager of the DoD Advanced Missile Reentry Systems program. BMO has responsibility for the Minuteman and Missile-X Program Offices.

(U) RELATED ACTIVITIES: BMO uses the capabilities of the Air Force laboratories, centers, ranges, and other AFSC in-house capabilities to the maximum extent feasible in all phases of systems planning, development, acquisition, and test. Related Program Element is 65304F, Acquisition and Command Support (ACS) Telecommunications.

(U) WORK PERFORMED BY: Ballistic Missile Office, Norton AFB, CA. There are no major contracts at BMO funded by this program element. Minor contractual effort is provided through host base support contract.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not applicable.
2. (U) FY 81 Program: This is an in-house effort by the organization cited above which supports many program elements and projects in the Research, Development, Test and Evaluation community, and procurement programs.

DOD Mission Area: General Management Support #471

Title: Ballistic Missile Office (BMO)

Budget Activity: Defense-wide Mission Support. #6

3. (U) FY 1982 Planned Program: This is a continuing program, the main cost of which is for pay of personnel. Ninety percent of the total is for pay of personnel. Increase effort will be on the Missile-X program.
4. (U) FY 1983 Planned Program: No major changes for foreseen in the nature of this element at this time.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable
7. (U) Resources: (\$ in thousands)

FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
6,378	7,278	7,960	8,045	Continuing	Not Applicable
FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Cost
5,000	7,5000	7,747		Continuing	Not Applicable

8. (U) Comparison With FY 1981 Budget Data:

FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Cost	Not Applicable
5,000	7,5000	7,747		Continuing		

***Excludes Reimbursements**

6921 6921 6921

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65807F

DOD Mission Area: Major Ranges and Test Facilities, #451

Title: Test and Evaluation Support

Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	
							Continuing	Not Applicable
	TOTAL FOR PROGRAM ELEMENT	316,975	326,237	365,500	TBD			
2109	Arnold Engineering Development	94,821	105,889	117,559	TBD	Continuing	Not Applicable	
2110	Western Space and Missile Center (WSMC)	596	1,500	1,800	TBD	Continuing	Not Applicable	
2111	Armament Division	98,132	97,340	102,188	TBD	Continuing	Not Applicable	
2112	Air Force Flight Test Center	78,518	75,995	86,464	TBD	Continuing	Not Applicable	
2114	4950th Test Wing	44,908	45,513	57,498	TBD	Continuing	Not Applicable	

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides resources for operating the above Air Force Systems Command test activities. Operation of the activities includes both technical and base support functions. These activities provide test and evaluation support to Air Force programs, those of other Services and Government agencies, and commercial companies. Many capabilities possessed by the test activities are unique and cannot be found elsewhere.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The program supports the operation and maintenance of the RDT&E activities and includes pay and related costs of civilian personnel, travel, transportation, rents, communications, utilities, contractual services, supplies and equipment. Past history, projected workload and use of approved inflation indices form the basis for this cost estimate. The increase in the FY 1982 request is due primarily to a \$6.1 million inflation increase, a \$10.2 million increase in the cost of Petroleum, Oils and Lubricants, a \$8.9 million increase for a civilian pay raise and some programmatic changes.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980 Estimate	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	
						Continuing	Not Applicable
	292,875	315,200	339,800				

(U) OTHER APPROPRIATION FUNDS:

Military Construction	12,100	24,200	2,850	TBD	Continuing	Not Applicable	
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Program Element: #65807F

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Test and Evaluation Support

Budget Activity: Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This Program Element resulted from the consolidation of three other Program Elements effective with the start of FY 1975. The old Program Elements were: 65301F - Space and Missile Test Center (SAMTEC); 65802F - Arnold Engineering Development Center (AEDC); and 65807F - Development and Test Support which included the Armament Development and Test Center (now the Armament Division (AD)), the Air Force Flight Test Center (AFPTC), and the Air Force Special Weapons Center (AFSWC) (now part of the Air Force Weapons Laboratory (AFWL)). Also effective in FY 1975, all test activities in this Program Element began to earn direct cost reimbursements from Test and Evaluation customers under the uniform funding policy established by Department of Defense Directive 3200.11. During FY 1977 an analysis was conducted on the Western Space and Missile Center (WSMC) workload which determined that the majority of programs supported were operational and that effective in FY 1979, WSMC operation should be funded in the operations and maintenance appropriation.

(U) RELATED ACTIVITIES: The test activities provide test and evaluation support to Air Force programs and those of other Services and Government agencies. Examples include the Air Force Air Launched Cruise Missile, F-15, F-16, MX, Inertial Upper Stage, and National Aeronautics and Space Administration Space Shuttle. Additional related activities are covered under each project.

(U) WORK PERFORMED BY: AEDC, Arnold AFS, TN; AD, Eglin AFB, FL; AFPTC, Edwards AFB, CA; 4950th Test Wing, Wright-Patterson AFB, OH. Major contractors performing work at the center, shown in parenthesis, include: Arnold Research Organization, Inc. PAN AM World Services and Calspan Field Services, Inc. (AEDC); VITRO Services (AD); RCA Missile and Service Division (AD); and Dynallectron Corp (6585 Test Wing, Holloman AFB, NM).

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: See attached project descriptions.
2. (U) FY 1981 Program: See attached project descriptions.
3. (U) FY 1982 Program: See attached project descriptions.
4. (U) FY 1983 Program: See attached project descriptions.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not Applicable.
7. (U) Resources: See attached project description.

Project: #2109

Program Element: #65807F

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Arnold Engineering Development Center (AEDC)

Title: Test and Evaluation Support

Budget Activity: Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: AEDC provides ground environment test support for all Department of Defense aeronautical, missile, and space programs, such as Minuteman, M-X, F-15, F-16, Air Launched Cruise Missile, Advanced Strategic Air Launched Missile, and Advanced Ballistic Re-Entry System, as well as for other Government agency and industry programs. The center has three facility complexes encompassing wind tunnels, altitude rocket cells, aeroballistic ranges, altitude engine cells, space chambers, and required support and administrative facilities. The test facility complexes are: Von Karman Gas Dynamic Facility which performs aerodynamic testing of scale models of aircraft, missile and space systems from Mach 1.5 to 10, testing of large and full-scale satellites, sensors and space vehicles in a simulated space environment, and tests of projectiles (both high performance and conventional gun) at various altitudes and re-entry conditions; Engine Test Facility which provides altitude environmental testing for aircraft, missile, and spacecraft propulsion systems including turbojets, turbofans, and both liquid and solid propellant rockets; and, Propulsion Wind Tunnel Facility which provides tests of large-scale models, and in some cases, fullscale engine inlet combinations, missiles, and space boosters together with their propulsion systems at Mach numbers from 0.5 to 4.5. This national test center is used to evaluate aerospace systems, hardware, concepts and prototypes in simulated operating environments to assist project managers and program directors in effective development and acquisition of their systems. These test complexes are used to assist in obtaining an optimal design, evaluation and certification of performance and acceptance of hardware by providing accurate data at minimum cost.

(U) RELATED ACTIVITIES: The Center also supports programs of the National Aeronautics and Space Administration such as Space Shuttle, the Army Ballistic Missile Division, the Navy, as well as technology support to the Department of Energy. The Center's facilities are national assets that provide unique test capabilities not available elsewhere.

(U) WORK PERFORMED BY: Under the direction of the Air Force Systems Command, the AEDC Commander and his staff provide the overall planning, programming, funding, and administration of AEDC. The operation of the test facilities and support activities at AEDC is performed by the operating contractors. Approximately 80 percent of the AEDC institutional budget is used for the operating contracts. Currently, Arnold Research Organization (ARO) Inc., AEDC Division of Sverdrup Corporation, is the sole operating contractor. Their contract expires 31 December 1981. Effective 1 January 81, AEDC will be operated and maintained by three operating contractors, one for each of three function areas. ARO, Inc will be responsible for Propulsion Testing including activation and operation of the Aero-propulsion Systems Test Facility. CALSPAN Field Services, Inc, a subsidiary of Calspan Corporation, will be responsible for Aerospace Flight Dynamics Testing (all other testing). PAN AM will be responsible for the mission support functions. All contracts are for approximately 3 years (1 January 1980 - 30 September 1983) and have two one-year options. CALSPAN and PAN AM will be in a phase-in mode of operation until 1 January 81. Other contractors working on special tasks include: Grumman Data Systems, Bethpage, NY; Westinghouse, Sunnyvale, CA; Daniel, Mann, Johnson & Mendenhall, Los Angeles, CA; Brown Boveri, Switzerland; Sulzer Brothers, Switzerland; Axel Johnson, San Francisco, CA; Mosser, Bethlehem, PA; Clow Corp, Chicago, IL; Rotoflow Corp, Los Angeles, CA; and Carrier, Syracuse, NY.

Project: #2109

Program Element: #65807

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Arnold Engineering Development Center (AEDC)

Title: Test and Evaluation Support

Budget Activity: Defensewide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: AEDC has provided vital environmental test support to most of the national aerospace system development programs such as the F-15, F-16, B-1, A-10, F100/F101 Engine Model Derivative Program (EMDP), F-5E, Advanced Ballistic Re-Entry System (ABRES), F-111, Minuteman, Inertial Upper Stage (IUS), Titan, Air Launched Cruise Missile (ALCM), Advanced Strategic Air Launched Missile, Air Force Flight Dynamics Laboratory (AFFDL) and the NAVSTAR satellite. Major direct support for environmental testing was provided for advanced surveillance devices, aerospace propulsion and flight dynamics and munitions development. Additional support was provided to Air Force Logistics Command (AFLC) for Engine Baseline performance and trending. Starting in FY 1975, a funding policy was implemented where the customers pay for the direct cost portion of their testing efforts. Congressional approval was issued in 1977 for construction of the Aeropropulsion Systems Test Facility. This facility, programmed at \$437 million, will be a national test facility capable of simulating altitude flight conditions for integrated aerodynamic and propuls tests of very large aircraft engines. Construction is progressing towards an Initial Operational Capability (IOC) in December 1984. The exact IOC will be dependent upon the level of funding provided to activate the facility. It can range from a near date of December 1984 to a delayed date of September 1987.
2. (U) FY 1981 Program: Major direct support for environmental testing is being provided for the F-16, ALCM, Advanced Medium Range Air-to-Air Missile (AMRAAM), Wasp, Inertial Upper Stage, ABRES, and Missile-Experimental (MX). Support will also be provided to the AFFDL, as well as to the Air Force Aeropropulsion Laboratory, the Air Force Rocket Propulsion Laboratory and the Air Force Armament Test Laboratory. Support to Air Force Logistics Command, Army, Navy, and National Aeronautics and Space Administration (NASA) will continue. F100 Engine Component Improvement Program testing will be conducted as well as tests for F101 Derivative Fighter Engine development. Magnetohydrodynamic technology and test support will be provided to the Department of Energy.
3. (U) FY 1982 Planned Program: The Center will continue to be a prime contributor to the successful development of Department of Defense and NASA aeronautical, missile and space systems, ABRES, Advanced Medium Range Air-to-Air Missile, Wide Area Anti-Armor Munition, Space Shuttle, MX, F-16, Stores Separation testing, and ALCM. Aerodynamic testing programs will be conducted for the Foreign Technology Division, Scientific and Technology Intelligence Programs, Aerospace performance testing. Additionally, AEDC will provide support for other Services, such as the Navy and Army, and commercial companies. Magnetohydrodynamic technology support to the Department of Energy will continue. In order to provide the best possible test data at minimum cost AEDC will maintain its continuing effort in developing technology and instrumentation to improve and modernize its existing capabilities with this goal in mind. AEDC will initiate the true Test Center Concept approach to testing. This concept permits more government involvement in test planning, conduct, data acquisition and analysis. Inflation, increases in Petroleum, Oil and Lubricants, True Test Center Concept and some programmatic changes account for the increase in funding over FY 81.

Project: #2109

Program Element: #65807

DOD Mission Area: Major Ranges and Test Facilities, #451

Title: Arnold Engineering Development Center (AFDC)
Title: Test and Evaluation Support
Budget Activity: Defensewide Mission Support, #6

4. (U) FY 1983 Planned Program: The statements in paragraph 3 also apply in FY 1983.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

Additional
to
Completion
Continuing

Total
Estimated
Cost
Not Applicable

FY 1983
Estimate
TBD

FY 1982
Estimate
117,559

FY 1981
Estimate
105,889

FY 1980
Estimate
94,821

ROT&E*

8. (U) Comparison with FY 1981 Budget Data:

FY 1982
Estimate
111,080

FY 1981
Estimate
105,050

FY 1980
Estimate
93,775

ROT&E*

*Excludes Reimbursements

Project: #2110

Program Element: #65807F

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Western Space and Missile Center (WSMC)/Western Test Range (WTR)

Title: Test and Evaluation Support

Budget Activity: Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The WSMC operates the WTR which provides range tracking, data acquisition, and flight safety support for all aeronautical flights, and ballistic missile and space system launches from Vandenberg AFB, CA. The WSMC operates an integrated system of radars, optical tracking instruments, telemetry receivers, range safety command destruct transmitters, computers, and data transmission and display equipment. Operating sites include: Vandenberg AFB and Pillar Pt, CA and Wheeler AFB, Molokai and Kaena Pt, HI. This program element provides for the research and development of new range instrumentation at a test facility whose funding is predominately operations and maintenance (O&M). The remainder of WSMC/WTR funding is in Program Element 78032F, O&M.

(U) RELATED ACTIVITIES: The WSMC provides common range support for: Strategic Air Command (SAC) ballistic missile operational testing; Air Force Space Division polar orbit and Ballistic Missile Office ballistic re-entry vehicle launches; other Department of Defense sponsored range users; the National Aeronautics and Space Administration polar orbit launches; on-orbit tracking of satellites launched from the Eastern Test Range; and support to the Navy Pacific Missile Test Center. Funds for WSMC Defense Communications Services and other leased communication services are carried under Program Element 78034F. SAC provides host base services to WSMC at Vandenberg AFB. The majority of funding for WSMC/WTR is in Operations and Maintenance, PE 78032F. Only \$1.5 million Research, Development, Test and Evaluation remains for developmental improvement expenditures.

(U) WORK PERFORMED BY: Air Force management is under the Air Force Western Space and Missile Center, Vandenberg AFB, CA. Major contractors are: Federal Electric Corporation, Division of International Telephone and Telegraph, Paramus, NJ, provides operation and maintenance of range instrumentation; Aeronautic-Ford Corporation, Fort Washington, PA, operates the Vandenberg AFB, Precision Measurements Equipment Laboratory; Computer Sciences Corporation, Los Angeles, CA, provides computer engineering technical services; and Logicon, Inc., Torrance, CA, provides verification and validation of flight safety computer programs. Other contractors include: Bionetics, Hampton, VA; Science Applications Inc., LaJolla, CA; Southern Pacific Transportation Company, San Francisco, CA; and Xerox Corp, Los Angeles, CA.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: WSMC assumed responsibility for intercontinental ballistic missile and space vehicle range support functions from the Navy on 1 February 1965. The FY 1966 program provided for the consolidation and integration of range operations and the establishment of a communications center at Wheeler AFB, HI. The FY 1969 program provided for the installation of new mid-course tracking radar in the Hawaiian Islands and centralization of telemetry and peripheral equipment and data handling, processing, and display. The 1970 through 1974 programs provided for development of a new terminal/re-entry support site in the Phoenix Islands for Strategic Air Command operational testing of the Minuteman III, instrumentation improvement modifications to range ships, a tracking accuracy improvement modification of the WSMC radar in Hawaii major upgrading of the WSMC telemetry capability, acquisition of instrumentation to support the Minuteman III Operational Base Launch program at Vandenberg AFB, CA: initiation of development of an unattached scoring system, new range safety Digital Instrumentation Radar

Project: #2110

Program Element: #65807

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Western Space and Missile Center (WSMC)/Western Test Range (WTR)

Title: Test and Evaluation Support

Budget Activity: Defensewide Mission Support, #6

and continued minimum essential improvements to range instrumentation and communications. Support to the Airborne Warning and Control System and B-1 programs began in FY 1976-1977 and added to WSMC's Development Test and Evaluation (DT&E) workload. Minuteman III testing increased significantly in FY 1977 to support Improved Guidance, Missile Precision Measurement System and MK-12A Re-entry Vehicles DT&E requirements. Implementation of the Telemetry Integrated Processing System and Range Safety Display System began in FY 1978. The WSMC operating funds were transferred to Operations and Maintenance effective FY 1979, with only instrumentation development funds remaining with Project 2110.

2. (U) FY 1981 Program: The \$1.5 million RDT&E for FY 1981 will be used for design and hardware/software development for the MPS-36 Antenna Improved Feed, Acoustic Monitoring System and Global Positioning System - Sonobuoy Missile Impact Location System (GPS-SMILS).

3. (U) FY 1982 Planned Program: The FY 1982 program totals \$1.8 million for completion of the MPS-36 Antenna Improved Feed, development/installation/testing of the Command Control Transmitter Secure Coding System and continued development of the GPS-SMILS.

4. (U) FY 1983 Planned Program: The \$1.5 million will fund a major portion of the Concept Validation (phase I) of the GPS-SMILS development.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) RESOURCES: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>To</u> <u>Completion</u>	<u>Total</u> <u>Estimated</u> <u>Cost</u>
RDT&E*	596	1,500	1,800	TBD	Continuing	Not Applicable

8. (U) COMPARISON WITH FY 1981 BUDGET DATA:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>
RDT&E*	900	1,500	1,500

* Excludes Reimbursements

Project: #2111

Program Element: #65807F

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Armament Division (AD)

Title: Test and Evaluation Support

Budget Activity: Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The AD is the host organization at Eglin AFB, FL and is the prime Air Force organization charged with non-nuclear armament development. As of 1 October 1979, AD (formerly Armament Development and Test Center) became a full product division. In this role, AD: accomplishes engineering development, test, evaluation, and initial acquisition of Air Force non-nuclear munitions; acts as the focal point for munitions integration in aeronautical systems; conducts and supports Air Force Weapons Effectiveness Testing, electromagnetic warfare testing, electronics surveillance and control testing, aeronautical systems testing; operates the 6585th Test Group's (at Holloman AFB, NM) Central Inertial Guidance Facility, the world famous 50,000-foot precision rocket sled track, the Radar Target Scatter Site and sponsors all Air Force programs that use the ARMY's White Sands Missile Range; and supports and participate in the United States Air Force, Department of Defense (DoD), and other governmental agencies test and evaluation programs as required. Eglin is the largest Air Force Base in the free world encompassing 734 square miles of land and a 44,000 square mile Gulf Test Range extending 400 miles south into the Gulf of Mexico. AD conducts more than 400 test projects per year with the emphasis in the field of conventional munitions. To carry out this program, AD utilizes 42 aircraft and over 50 instrumented test areas, sites, and ranges. The ranges are divided into four categories: The Armament Systems Test Environment, The Electromagnetic Test Environment, The Multi-purpose Resources, and the Water Test Areas. The Test and Evaluation effort and base operational support requirement are funded under this Program Element. The Acquisition and AD Staffs are funded under Program Element 65806.

(U) RELATED ACTIVITIES: AD supports the Air Force non-nuclear munitions development programs managed by the Air Force concerning the advanced development, engineering development, and initial production of non-nuclear munitions until transition to the Air Force Logistics Command. Test support is also provided to other Services and Government agencies. The Air Force Climatic Laboratory at Eglin AFB provides environmental testing for weapon systems programs of DoD. Related and complementary work is accomplished at the Air Force Flight Test Center, Arnold Engineering Development Center, Space and Missile Test Organization, all in Program Element 65807F Test and Evaluation Support; and the Product Divisions of PE 65806F, Acquisition and Command Support.

(U) WORK PERFORMED BY: Under the direction of the Air Force Systems Command, the AD Commander and his staff provide the overall planning, programming, funding, and administration of Armament Division, Eglin AFB, FL. The operation of the range facilities is accomplished by a contract with VITRO Services, Division of Automation Industries, Inc., Ft. Walton Beach, FL. Other contractors include: Dynallectron, Washington D.C.; Industrial Maintenance Services, Dothan, AL; Robbins Kirtland Incorp., Ft. Walton Beach, FL; Phillips Audio-Vidkeo, Mahwah, NJ; Bell Construction, Ft. Walton Beach, FL; Rivers Air Conditioning Corp., Shalimar, FL; DBA Systems, Melbourne, FL.; NB Associates, San Ramon, CA; and Boeing Aerospace Corp., Seattle, WA. There are 100 additional contracts divided among approximately 46 other contractors.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: AD's Eglin activities have primarily included the engineering development, test and evaluation, and initial acquisition of non-nuclear munitions and T&E of electromagnetic warfare instrumentation. The 6585th Test Group at Holloman has operated the Central Inertial Guidance Test Facility, the high

Project: #2111

Program Element: # #65807F

DOD Mission Area: Major Ranges and Test Facilities, #451

Title Armament Division (AD)

Title Test and Evaluation Support

Budget Activity Defensewide Mission Support, #6

speed test track, target drones, and the Radar Target Scatter Facility. In addition, AD supported: the collection, reduction, analysis, and evaluation of precise test data; and the preparation of technical reports. Major weapon systems supported by AD during FY 1980 included the F-111A Seek Fast, F-15 (TEWS), F-16 Seek Eagle, GBU-15 Cruciform Wing Weapon, B-52 Offensive Avionics System, AIM-7M, AIM-9M, and Advanced Medium Range Air-to-Air Missile (AMRAAM).

2. (U) FY 1981 Program. Fiscal year funds are used for the following purposes on a continuing basis: operate, maintain, and upgrade the highly instrumented 734 square mile test complex; conduct and support testing in the areas of Air Force non-nuclear munitions, electromagnetic warfare, and missiles and munitions/aeronautical systems integration; support United States Air Force, Office of the Secretary of Defense, and other Government agencies in test programs as required; provide administrative, logistical, and technical support to approximately 10,000 assigned tenant personnel.

3. (U) FY 1982 Program: Many of the FY 1981 efforts will continue. Typical programs requiring support will include Advanced Guidance Technology, F-16 SEEK EAGLE; F-15 TEWS, Low Level Delivery System (LLDS); Advanced Medium Range Air-to-Air Missile (AMRAAM) and Widearea Anti-Armor Munition (WAAM). Realign the acquisition at AD to Program Element 65806F, Acquisition and Command Support. Increase funding for instrumentation at the RADAR Target Scatter facility by \$2.0 million each year.

4. (U) FY 1983 Planned Program: Many of the FY 1982 efforts will be continued.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable.

7. (U) Resources: (\$ in thousands)

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to</u> <u>Completion</u>	<u>Total</u> <u>Estimated</u> <u>Cost</u>
MDT&E*	98,132	97,340	102,188	TBD	Continuing	Not Applicable

8. (U) Comparison with FY 1981 Budget Data:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>
MDT&E*	89,100	96,050	104,280

*Excludes Reimbursements

Project: #2112

Program Element: # #65807F

DOD Mission Area: Major Ranges and Test Facilities, #451

Title Air Force Flight Test Center (AFFTC)

Title Test and Evaluation Support

Budget Activity Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The AFFTC conducts and supports tests of aircraft and aircraft systems, aerospace research vehicles, remotely piloted vehicles, cruise missiles, and parachute delivery and recovery systems. Major weapon systems undergoing testing at Edwards Air Force Base (AFB), CA, include the A-10, F-15, B-1 and Air Launched Cruise Missile. The 6514th Test Squadron at Hill AFB, UT, conducts tests of Remotely Piloted Vehicle systems and the Ground Launched Cruise Missile using the Utah Test and Training Range to evaluate research, tactical and reconnaissance drone systems for military application. Air Force parachute testing is the responsibility of the 6510th Test Wing. The AFFTC also operates the United States Air Force Test Pilot School which annually trains 50 Department of Defense, allied, and contractor test pilots and flight test engineers.

(U) RELATED ACTIVITIES: The AFFTC provides facilities and support as required to the National Aeronautics and Space Administration (NASA) Hugh L. Dryden Flight Research Center (DFRC) and to the United States Army Aviation Engineering Flight Activity, major tenants at Edwards AFB. The NASA DFRC programs include the Space Shuttle and Transonic Aircraft Technology. The Army programs include tests of helicopter systems at Edwards AFB and at its high elevation test complex at Bishop, CA. The AFFTC also provides administrative and limited test support to the Air Force Rocket Propulsion Laboratory (AFRPL) located 15 miles east. The AFRPL programs include testing of rocket motors, nozzles, and propellants. Other Government agencies receive AFFTC test support as required. Nongovernment organizations not under Government contract may use AFFTC facilities, when available, to conduct independent testing, on a full cost reimbursement basis.

(U) WORK PERFORMED BY: Most of the tests and supporting activities are done by Air Force military and civilian personnel. The AFFTC provides facility and limited administrative support to NASA DFRC, the Army, and to tenant contractor organizations. It also provides full administrative support to the Rocket Propulsion Laboratory. However, all tenant organizations provide for their own direct maintenance. Kentron International, Dallas, TX, is the major range contractor for the Edwards Flight Test Range.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The AFFTC has been the center of aircraft and research vehicle flight test for many years because of its unique features: excellent flying weather, large restricted airspace, and the availability of natural dry lakebed runways. Programs which have undergone development testing at Edwards AFB include the F-105, XB-70, F-4, YF-12, the F-111 and the C-5A. Jointly, with NASA, the Air Force has tested the high altitude hypersonic X-15 research vehicle and the X-24 A/B lifting bodies. The ALCM flyoff was completed in FY 80. GLCM testing was begun as was support of B-52 improvement programs.

Project: #2112

Program Element: # #65807F

DOD Mission Area: Major Ranges and Test Facilities, #451

Title Air Force Flight Test Center (AFPTC)

Title Test and Evaluation Support

Budget Activity Defensewide Mission Support, #6

2. (U) FY 1981 Program: Testing is continuing on the A-10, F-15, F-16, B-1 and B-52 programs. The air and ground launched cruise missile (ALCM/GLCM) test organizations have been established. ALCM and GLCM testing are continuing this year. Parachute testing will continue on various parachute development programs. The National Aeronautics and Space Administration (NASA) is beginning orbital flight tests of the Space Shuttle; the Hugh L. Dryden Flight Research Center (DFRC) is scheduled to continue joint AF/NASA tests of the Highly Maneuverable Aircraft Technology vehicle.

3. (U) FY 1982 Planned Program: The A-10, F-15, F-16, B-52 and cruise missile programs are scheduled for additional testing in FY 1982. The Advanced Fighter Technology Integration test program will be jointly conducted with DFRC. NASA will continue orbital flight tests of the Space Shuttle with landings scheduled for Edwards AFB. The AFPTC will continue to play a key role in the successful development of Department of Defense aerospace systems. The cost increase from last year's summary resulted from inflation, petroleum, oils and lubricants (Price Increases), civilian pay raise, conversion of military to civilian billets and some increase in funds for maintenance and repair and improvements and modernization.

4. (U) FY 1983 Planned Program: The program shown for FY 1982 will continue into FY 1983. Support of the Prototype Minature Air Launched System test program will begin.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not applicable

7. (U) RESOURCES: (\$ in thousands)

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion Continuing	Total Estimated Cost Not Applicable
RDTE*	78,518	75,995	86,464	TBD		

8. (U) Comparison With FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982
RDTE*	71,600	71,140	78,430

*Excludes Reimbursements

Project: #2114

Program Element: # #65807F

DOD Mission Area: Major Ranges and Test Facilities, #451

Title 4950th Test Wing

Title Test and Evaluation Support

Budget Activity Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The 4950th Test Wing, Aeronautical Systems Division, Wright-Patterson Air Force Base (AFB), OH, performs flight tests of aircraft and airborne systems, supports space vehicle tracking for the Space Division and other DoD and National Aeronautics and Space Administration agencies, and operates the Air Force Systems Command (AFSC) Class II modification facility. Flight test activities have varied from evaluations of airborne side-firing cannon to investigations of state-of-the-art airborne laser systems and night attack sensors. The Wing has the test support facilities to conduct full-scale engineering evaluations. These facilities include a complete airborne instrumentation and data reduction, major/minor Class II aircraft modification, and extensive technical photo capabilities Staging out of 25 overseas bases, the Advanced Range Instrumentation Aircraft (ARIA) fleet of eight aircraft provide tracking support for NASA and DoD missile launches out of Cape Canaveral, FL, and Vandenberg AFB, CA. The Deputy Commander for Aircraft Modification support is also provided to the Air Force Wright Aeronautical Laboratories. The Wing possesses functional responsibility for AFSC Class II Aircraft Modification policy.

(U) RELATED ACTIVITIES: The 4950th Test Wing supports DoD and NASA programs.

(U) WORK PERFORMED BY: Air Force personnel (55 percent civilian) accomplish about 94 percent of the workload of the 4950th. The remaining work is covered by contracts which total \$4.0 million. Major contractors include Digital Equipment Corporation of Dayton, OH, which performs computer maintenance, Bendix Corporation of Columbia, MD, which provides ARIA instrumentation maintenance, E-Systems of Greenville, TX, Hayes International Inco. of Birmingham, AL, Technology Inc. of Dayton, OH, and Systems Research Laboratory of Dayton, OH which provide supplementary engineering design and aircraft modification installation. About 18 percent of the 4950th's 11,500 hours of annual flying are in support of ARIA missions. The rest are flown for test, support, and proficiency training. The fabrication and Class II aircraft modification workload consumes about 350 man-years of direct labor effort annually.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The 4950th Test Wing was designated a Major Test Facility in November 1975 and was placed within the purview of DoD Directive 3200.11, the directive which governs the use, management and operation of major DoD ranges and test facilities. Some of the recent accomplishments in the flight test program are the development of the Infrared Warning Receiver, Pulse Doppler Map Match Navigation System, Long Range Electro Optical Receiver, HAVE BOUNCE, Coherent Emitter Location Test, Meteor Burst Communication System, and Long Range Passive Location System. During this period, eight F-4Es, two ARIA, and one CH-3 Helicopter were modified in support of the high priority Air Launched Cruise Missile (ALCM) program. The ARIA have supported such programs as Apollo and Venus Pioneer for NASA; Titan IIIC, Atlas Agena, and Minuteman for the Air Force; Poseidon and Trident for the Navy; and Pershing for the Army. The Wing has completely converted the second of two EC-135B fan engine aircraft for ARIA support.

Project: #2114

Program Element: # #65807F

DOD Mission Area: Major Ranges and Test Facilities, #451

Title 4950th Test Wing

Title Test and Evaluation Support

Budget Activity Defensewide Mission Support, #6

2. (U) FY 1981 Program: Some of the flight test programs currently being supported are Infrared Properties, Aerospace Radio Propagation, Defense Meteorological Satellite, Airborne Laser Laboratory, Aircraft Navigation System Verification, NAVSTAR, Tactical Bi-static Radar Test, Air Launched Cruise Missile, SEEK TALK, Joint Tactical Information Display System, Cross Eye Electronic Countermeasures (ECM) and Airborne Laser Communications System. In addition the Advanced Range Instrumentation Aircraft (ARIA) are supporting various Air Force, National Aeronautics and Space Administration (NASA), Army, and Navy programs. A significant improvement and modernization program is underway to update the ARIA instrumentation systems, to include an upgrade of airborne receivers and a Phased Array Telemetry Antenna System. The Wing awarded a contract to Aplicon Corporation to develop a Computer Aided Design (CAD) system for the Deputy Commander for Aircraft Modification. This system will be developed into a total capability involving Computer Aided Manufacturing (CAM) throughout the fiscal year.

3. (U) FY 1982 Planned Program: Continue efforts on existing programs. Support of the Precision Location Strike System, Adaptive Communications, and small Super High Frequency satellite communications is also planned. The ARIA will continue to support future DoD and NASA launch requirements. CAD/CAM systems will be operational. The cost increase from last year's summary was caused primarily by price increases for petroleum, oil lubricants, inflation and the acquisition of a phased array telemetry system for the ARIA aircraft. In addition, there was an increase in maintenance, repair improvement and modernization activities along with a civilian pay raise and conversion of military to civilian to billets.

4. (U) FY 1983 Planned Program: The 4950th Test Wing will continue to support flight test programs. CAD/CAM system full-up on line in conducting normal Class II aircraft modification projects.

5. (U) Program to Completion: This is continuing program.

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Cost
RDTE*	44,908	45,513	57,489	TBD		

8. (U) Comparison With FY 1981 Budget Data:

	FY 1980	FY 1981	FY 1982
RDTE*	37,500	41,460	44,510

*Excludes Reimbursements

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65808F

Title: Advanced Systems Engineering/Planning
Mission Area: Technical Integration/Studies & Analyses, #440 Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING) (\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT		5,300	4,100	5,100	5,700			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force conducts development planning (mission area planning, systems architecture, and systems planning) to convert operational requirements into effective weapon systems. This Advanced System Engineering/Planning Program provides technical support for the development planning function at the Electronic Systems Division and the Space Division. This includes the definition of technology needs, the macro-system planning or architecture required to meet national objectives and the initial system definition necessary to satisfy operational requirements.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This request will provide technical support for the development planning function at the Electronic Systems Division and the Space Division. This effort will include the identification of new technology required for future systems; the future architectural plans for strategic and tactical systems; and initial engineering design for future systems required to satisfy operational requirements. Budget estimates are based on manpower costs for similar, completed projects.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E Procurement	4,200	4,400	5,100				
	Not Applicable						

(U) OTHER APPROPRIATION FUNDS: Not Applicable

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Program Element: #65808F

DOD Mission Area: Technical Integration/Studies & Analyses, #440

Title: Advanced Systems Engineering/Planning
Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: Development planning is the initial step in the systems acquisition process. The overall objective is the conversion of operational requirements into effective military capabilities. The development planning function includes: (1) mission area planning that broadly examines Air Force capabilities and potential deficiencies, and establishes development goals; (2) systems architecture that will provide a time-phased plan for meeting the development goals; (3) systems planning that will define initial system characteristics for a future weapon or support system. This program provides technical support for the development planning function in the strategic and tactical areas of command, control, communications, and intelligence at the Electronic Systems Division and for space systems at the Space Division. In addition to the Air Force personnel assigned to support this functional area, the Aerospace Corporation and the MITRE Corporation are the principal technical support contractors for the program.

(U) RELATED ACTIVITIES: The "technology needs" identified and published in the Technology Planning Guide provide guidance to the basic research and exploratory development planners and the associated 6.1 and 6.2 program elements. The space architecture and the command, control, communications and intelligence architecture activities supported by this program element provide the advanced development planners with the time-phased capabilities needed. The development planning activities are discussed with the other military services to prevent duplication and improve cooperation.

(U) WORK PERFORMED BY: The primary technical support for this program is provided by the Aerospace Corporation, El Segundo, CA, and the MITRE Corporation, Bedford, MA. Other contractors may be selected to provide technical support in specific areas. The Aerospace and MITRE Corporations have been designated Federal Contract Research Centers (FCRCs) and, as such, may have access to contractor proprietary data and to sensitive Air Force procurement information. This capability allows these Federal Contract Research Centers to provide unique and necessary support to the Air Force development planning function.

Program Element: #65808F

DOD Mission Area: Technical Integration/Studies & Analyses, #440 Title: Advanced Systems Engineering/Planning
Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: System architectural efforts have been emphasized to provide a basis for technology planning and future system acquisition. The Electronic Systems Division managed the Command, Control, Communications and Intelligence Architecture Project in support of the Tactical Air Forces, identified technology needs and published a Technology Planning Guide for use by the basic research and exploratory development planners. A computer technology planning task was initiated to reduce the problems associated with software procurement. The Space Division program focused on space and missile architecture, support to a study on the utility of military crews in space, all aspects of space sensor data management, an in-depth examination of an advanced military launch capability for the 1990s, and initial planning for a stand-off ballistic missile system to improve bomber survivability through increasing stand-off range.
2. (U) FY 1981 Program: The program activities at the Electronic Systems Division are emphasizing command, control, communications and intelligence architecture efforts in support of the Tactical Air Forces Integrated Information System (TAFIIS) Master Plan. This architecture effort is providing a time-phased system acquisition plan. The Technology Planning Guide is being updated. Computer software planning support is being continued to reduce software procurement problems. Advanced systems planning is continuing in the automatic data processing, communications and aerospace defense areas. Space Division architecture efforts are being accomplished with emphasis on the ground interfaces with military satellites. This approach to ground control architecture is taking into consideration the development of transportable ground terminals, mobile ground terminals, mission ground stations and relay satellites. The objective is to provide specific recommendations and guidelines to improve space system survivability. Advanced concepts currently being investigated include satellite clustering, atmospheric surveillance and warning, and attempts to better understand how space systems can provide decisive support to military forces. System feasibility investigations are being accomplished for a space based satellite data control system to better manage our space based military assets and an in-depth review is being accomplished in the military space flight capability area.
3. (U) FY 1982 Planned Program: The Electronic Systems Division program will emphasize command, control communications and intelligence architecture for the Tactical Air Forces. Specific areas to be stressed are forward air surveillance and identification concepts, ground target identification and strike capability and electronic warfare concepts. The Technology Planning Guide will be updated to include the current "technology needs" information. Additional effort will be applied in the electronic warfare/electronic counter-measures area primarily to provide a primary source of expertise to assist individual development programs. Space Division architecture efforts will complete the ground control architecture task. The advanced concepts investigations in the satellite clustering and atmospheric surveillance and warning areas will be completed. The space based satellite data management techniques and military space flight capability investigations are planned to continue.

Program Element: #65808F

DOD Mission Area: Technical Integration/Studies & Analyses, #440 Title: Advanced Systems Engineering/Planning
Budget Activity: Defense-wide Mission Support, #6

4. (U) FY 1983 Planned Program: The emphasis on tactical and strategic architectural activities and advanced system engineering efforts will be continued. The Electronic Systems Division will continue the advanced systems planning tasks in the automatic data processing, communications and aerospace defense areas. The Space Division plans to investigate manned space applications such as on-orbit maintenance/servicing and retrieval of satellites as well as an investigation of functions that can best be performed in space.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65890F

DOD Mission Area: General Management Support, #471

Title: Installation Audiovisual Support

Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCE (PROJECT LISTING) (\$ in thousands):

<u>Project Number</u>	<u>Title</u>	<u>FY 1980 Actual</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>
	TOTAL FOR PROGRAM ELEMENT	0	5,250	5,900	6,000	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This includes base Audiovisual (AV) libraries, photo labs, graphic arts, presentation services and other AV activities that support all AFSC bases and Research Centers.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Continue AV support to the RDT&E Community.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY: This was previously funded as a part of P.E. #65806, Acquisition and Command Support; and P.E. #65807, Test and Evaluation Support.

<u>FY 1980</u>	<u>FY 1981 Estimate</u>	<u>FY 1982 Estimate</u>	<u>FY 1983 Estimate</u>	<u>Additional to Completion</u>	<u>Total Estimated Costs</u>

(U) OTHER APPROPRIATION FUNDS: None

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Program Element: #65890F

DOD Mission Area: General Management Support, #471

Title: Installation Audiovisual Support

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This includes base Audiovisual (AV) libraries, photo labs, graphic arts, presentation services and other AV activities that support all AFSC bases and Research Centers.

(U) RELATED ACTIVITIES: This was previously funded as a part of P.E. #65806, Acquisition and Command Support; and P.E. #65807, Test and Evaluation Support.

(U) WORK PERFORMED BY: Base AV personnel

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This is a continuation of AV support to RDT&E activities on a yearly basis providing the base level AV support.
2. (U) FY 1981 Program: This is a continuation of AV support to RDT&E activities on a yearly basis providing the base level AV support.
3. (U) FY 1982 Planned Program: Base level AV support. This is a continuation of AV support to RDT&E activities on a yearly basis providing the base level AV support.
4. (U) FY 1983 Planned Program: Base level AV support. This is a continuation of AV support to RDT&E activities on a yearly basis providing the base level AV support.
5. (U) Program to Completion: N/A
6. (U) Milestones: N/A

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #65898F

DOD Mission Area: General Management Support, #471

Title: Management Headquarters - Research and Development
Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion Continuing	Total Estimated Costs	Not Applicable
<u>TOTAL FOR PROGRAM ELEMENT</u>								
		18,901	19,800	23,800	24,400			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the resources to support the Commander, his staff, the technical mission and support functions for Headquarters Air Force Systems Command (HQ AFSC). Categories of cost include pay and the related costs of civilian personnel, travel, transportation, rents, contractual services, supplies, and equipment.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This is a continuing program which provides the resources to support the commander his staff, the technical mission, and support functions for HQ AFSC. The FY 1982 program reflects civilian pay raises and increased costs to support the Management Headquarters Research and Development effort. Also included are new contractual efforts to support industrial preparedness requirements.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

RDT&E	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs	Not Applicable
	17,751	21,312	23,199				

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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Program Element: #65898F

DOD Mission Area: General Management Support, #471

Title: Management Headquarters - Research and Development

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The mission of Air Force Systems Command (AFSC) is to advance aerospace science and technology, apply it to aerospace systems development and improvement, and acquire qualitatively superior aerospace systems and equipment needed to accomplish the Air Force mission. Specifically, the Commander and his staff: manage the aerospace systems equipment acquisition programs; act as the primary Air Force agent for technical advocacy of development programs to provide the technology and capability to fulfill known or anticipated Air Force operational requirements; maintain in-house laboratories of superior quality to conduct research in selected scientific areas to provide Air Force competence; plan, develop, and manage - through a central authority - aerospace vehicle launch facilities, range communication-electronics and instrumentation, worldwide satellite control, and recovery facilities for assigned Department of Defense (DoD), National Aeronautics and Space Administration (NASA), and other United States Government agency programs; plan, conduct, and manage systems; systems support; research, exploratory development engineering, and advanced development programs in bioastronautics, research programs in support of the Air Force personnel systems, clinical and aerospace medicine requirements, and specialized aerospace medical education programs; conduct and manage foreign technology program to provide a current foreign aerospace technical threat assessment for use in systems planning and acquisition; perform development testing and evaluation to establish the technical adequacy, safety, environmental consequences, and qualitative characteristics of systems and equipment; conduct such research and development activities as necessary to insure that environmental and ecological considerations are reflected in the course of accomplishing the overall mission; and provide liaison between the Air Force and the scientific community in areas of potential Air Force interest. This program provides the resources for the commander to meet this mission.

(U) RELATED ACTIVITIES: In addition to the above responsibilities, the AFSC provides technical assistance to other major commands in conducting their operational test and evaluation activities; supports the other Services in developing and procuring aerospace items according to current directives; provides-by agreement or on request - foreign aerospace technological data and support to Headquarters United States Air Force (HQ USAF), Major Commands, NASA, and agencies of the national intelligence community; manages the Electromagnetic Compatibility Analysis Center in support of DoD and other Government agencies; established appropriate precedence rating alignment of all units within the precedence categories; informs HQ USAF of areas of conflict owing to changing forces, mission, or emphasis, maintains close liaison with the Federal Aviation Administration to insure the compatibility of Air Force aircraft with other elements of the National Airspace Systems and the ability to operate in airspace under the administration of the International Civil Aviation Organization. Related activities include all Air Force program elements.

(U) WORK PERFORMED BY: Headquarters AFSC, Andrews AFB, MD, performs staff management for work which is performed by Aeronautical Systems Division, Electronic Systems Division, Aerospace Medical Division, Space Division, and the Armament System Program Offices at Armament Division within Program Element 65806F, Acquisition and Command Support, and laboratories, test centers and national ranges funded by other program elements. Major contracts include: Honeywell Corp., McLean, VA for automatic data processing equipment rental; Saxon Corp., Fairfax, VA; 3M, Springfield, VA; IBM, Rockville, MD; and Xerox Corp., Arlington, VA, for lease of reproduction equipment.

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Program Element: #65898F

DOD Mission Area: General Management Support, #471

Title: Management Headquarters - Research and Development
Budget Activity: Defense-wide Mission Support, #6

(U) PROGRAM ACCOMPLISHMENT AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: This is a continuing program. Funds were used to support the Commander, his staff, the technical mission and support function for Headquarters Air Force Systems Command (HQ AFSC).
2. (U) FY 1981 Program: This is a continuing program supporting the HQ AFSC Commander and staff.
3. (U) FY 1982 Planned Program: The planned program will provide resources to continue operation of HQ AFSC. The cost delta from last year's summary reflects inflation costs and civilian pay raises.
4. (U) FY 1983 Planned Program: The FY 1983 program continues the FY 1982 effort.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35110F

Title: Satellite Control Facility

DoD Mission Area: Space Launch and Orbital Support, #410

Budget Activity: Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ IN THOUSANDS)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		14,700	14,000	69,500	39,100	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This objective of this program is the maintenance of a highly reliable national satellite tracking, telemetry and commanding capability to support the development and operation of DOD satellite systems. The Air Force Satellite Control Facility (AFSCF) consists of a global network which includes instrumentation systems, antennas, communications and data processing equipment required to support a growing inventory of increasingly complex space vehicles.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program will provide a scientific and engineering capability to develop and maintain a network configuration capable of providing user satellite system support and insure system compatibility. The FY 1982 RDT&E funding represents the amount required to carry on continuing project efforts and provides a program for data system development to provide required network capacity and upgrade systems to meet evolving satellite support requirements.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Estimated Costs
RDT&E						
Procurement (Aircraft)*	14,700	14,100	20,400		Continuing	Not Applicable
Procurement (Other)	1,018	1,117	1,240		Continuing	Not Applicable
Military Construction	9,629	19,223	34,607		Continuing	Not Applicable
	3,150				Continuing	Not Applicable
(U) OTHER APPROPRIATION FUNDS:						
Procurement (Aircraft)*	1,018	1,129	1,428	1,526	Continuing	Not Applicable
Procurement (Other)	9,171	19,648	582	17,205	Continuing	Not Applicable
Military Construction	3,150		6,900	7,418	Continuing	Not Applicable
Operations and Maintenance	38,975	42,729	51,181	56,792	Continuing	Not Applicable

* Spares only

FY 1981 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35110F

Title: Satellite Control Facility

DoD Mission Area: Space Launch and Orbital Support, #410

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Satellite Control Facility (SCF) is a world-wide network consisting of a Headquarters at Sunnyvale, CA, seven geographically dispersed tracking stations, a communications satellite calibration site at Camp Parks, CA, a control center (the Satellite Test Center (STC) at Sunnyvale), and a satellite recovery group at Hickam AFB, HI. The mission of the SCF is to provide tracking, real-time telemetry, commanding, (TT&C), and recovery of Department of Defense (DOD) space vehicles operating in a multi-satellite environment. The SCF supports satellites operating with various orbital parameters to accomplish diversified test and operational objectives. A complex instrumentation system consisting of antennas, communications, and data processing equipment provides the means of meeting the ground support requirements of the many space vehicles. This appropriation provides for the development, installation and modification of network components to meet satellite program support requirements. The SCF provides on-orbit support to satellite programs of the Air Force, the Navy, other DOD agencies, the National Aeronautics and Space Administration, and the North Atlantic Treaty Organization. Support commences prior to launch and in most cases, continues throughout the life of the satellite to include recovery, if required. Efforts accomplished under this program either correct system deficiencies or allow for increased program support.

(U) RELATED ACTIVITIES: Both Defense Communications System (DCS) and non-DCS telecommunications program activities relating to the SCF are contained in Program Element 35151F (SCF Telecommunications). The Real Property Maintenance activities relating to the SCF are contained in Program Element 35894F (Real Property Maintenance, AFSC). The majority of DOD satellite programs rely to varying degrees on the SCF for TT&C support. The Consolidated Space Operations Center (CSOC), PE 35130F, will provide increased capability by sharing the control functions of the STC.

(U) WORK PERFORMED BY: Air Force management of this National Range is under the Space Division, Los Angeles, CA. Principal contractors are: Lockheed Missile and Space Company, Sunnyvale, CA, which provides study and development analysis for the STC; Ford Aerospace, Palo Alto, CA, which provides study and development analysis for the Remote Tracking Stations (RTS); and Systems Development Corporation, Santa Monica, CA, which provides computer system integration. Competitors in a parallel development effort for the Data System Modernization (DSM) include Hughes Aircraft Corporation, Boeing Aerospace Corporation and IBM Corporation. IBM was awarded the follow-on development/acquisition contract.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: The SCF was initially configured during 1956-1957 to provide on-orbit support for the Discoverer Program. Since then, many new space programs have been added, with older programs being upgraded or deleted. This has resulted in a fluctuating satellite inventory which has varied in recent years from less than 35 to over 55 satellites which required support. In FY 1979, the network supported an average of 46 satellites on-orbit simultaneously. This average is increasing annually as is the overall SCF workload which is expected to increase 15% by 1981. This expanding workload is primarily the result of the lengthened satellite on-orbit lifetime and the increasing complexity of spacecraft and space operations.

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Program Element: #35110F

DoD Mission Area: Space Launch and Orbit Support, #410

Title: Satellite Control Facility

Budget Activity: Defense-wide Mission Support, #6

Since its inception, the Satellite Control Facility (SCF) has undergone significant evolution in order to provide the required satellite support services. In 1966 a standard integrated tracking, telemetry and commanding system (TT&C) was installed at all remote tracking stations (RTS) to provide a common system. Wideband communications capabilities have been achieved through installation of an interim system in 1973. The Defense Communication System/SCF Interface System (DSIS) is now providing wideband communication. More capacity has been added to the network with the addition of a second antenna at Guam (1979) and Thule, Greenland (1979) and the SCF use of the British Telemetry and Commanding Station at Oakhanger, England starting in 1978. Additional satellite communications are provided between the Satellite Test Center (STC) and the RTSs using the Satellite Data System. The standard TT&C system has been augmented by installation of a Time Division Multiplex (TDM) system at the Indian Ocean Station for initial support of the Space Transportation System. For operational use of the STS, all RTSs will be equipped with TDM systems. Three Parallel development contracts were let in June 1979 for the first phase of the SCF Data System Modernization (DSM) project. The competitive contracts produced design concepts for a centralized data system that will replace the aging computer systems throughout the SCF. The modernized system will greatly increase the network capacity as well as significantly reduce operating cost by decreasing the manpower intensity of numerous satellite support functions.

2. (U) FY 1981 PROGRAM: The Satellite Control Facility will continue the planning, development, acquisition, operation and maintenance of systems necessary to support the needs of current and planned space programs. Satellite recovery equipment and mission control center modifications dictated by satellite program requirements will continue. Facilities and equipment for SCF support of the Space Transportation System, including both orbiter and inertial upper stage, will be developed and provided. The Data System Modernization development/acquisition contract was awarded in December 1980.

3. (U) FY 1982 PLANNED PROGRAM: Ongoing efforts to meet evolving satellite program requirements will continue. Major efforts include modifying and equipping the mission control complex for a new classified satellite program. Network modifications required for Shuttle applications will continue. The most significant portion of the FY 1982 RDT&E program will be the software development work associated with the DSM. The increase over the 1981 projection is due to DSM acceleration required to support a new classified satellite program, a shift of funds from procurement to RDT&E to be more consistent with the early developmental nature of the DSM and to reflect the negotiated contract price.

4. (U) FY 1983 PROGRAM: Ongoing efforts including the software development/conversion work for the data systems modernization will be continued. The facility modifications to support DSM will be initiated.

5. (U) PROGRAM TO COMPLETION: This is a continuing program.

6. (U) MILESTONES: Not Applicable.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35119F

DOD Mission Area: Space Launch and Orbital Support, #410

Title Space Boosters

Budget Activity Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)(\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		29,700	29,394	19,300	TBD	TBD	TBD

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The need exists to continue to provide a highly reliable means of placing critical Department of Defense satellites into their required mission orbits until the Space Shuttle becomes operational and all satellite programs have completed transition to the Space Shuttle. This program meets this need by providing for the engineering support and flight performance assessment of the Department of Defense Atlas-E/F and Titan III space launch vehicles which are a part of the national launch vehicle family. This program also provides the resources for the Titan III(34)D/Inertial Upper Stage integration, for integration of the Transtage onto the Titan III(34)D, and for Atlas-E/F launches of Air Force Research and Development satellites.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The basic Atlas-E/F and Titan III reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. The engineering design and development program to integrate the Inertial Upper Stage and its technology into the Titan III space launch vehicle family will continue. Initial Launch Capability for the Titan III(34)D/Inertial Upper Stage at Cape Canaveral Air Force Station, FL, is now scheduled for April 1982. Initial Launch Capability for the Titan III(34)D at Vandenberg Air Force Base, CA, is scheduled for December 1981. The engineering design and development program to integrate the Transtage onto the Titan III(34)D will continue to support an Initial Launch Capability at Cape Canaveral Air Force Station, FL, in December 1982. Support of two Atlas-E/F launches for NAVSTAR Global Positioning System Research and Development satellites is planned in FY 1982. The cost estimate for this program was developed from the extensive historical data which have been collected on this program.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E	29,700	29,500	14,000		8,300	1,251,100
Procurement (Missile)	44,000	66,813				186,213

Program Element: #35119P

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Boosters
Budget Activity Defense-wide Mission Support, #6

(U) OTHER APPROPRIATION FUNDS:

	<u>FY 1980</u>	<u>FY 1981</u> <u>Estimate</u>	<u>FY 1982</u> <u>Estimate</u>	<u>FY 1983</u> <u>Estimate</u>	<u>Additional</u> <u>to Completion</u>	<u>Total</u> <u>Estimated</u> <u>Costs</u>
Procurement (Missile)	44,000	121,251	113,267	TBD	TBD	TBD
(Quantity - Titan III(34)D)	(2)*		(2)*			
(Quantity - Transtage)		(2)	(2)**			
Operation and Maintenance	50,312	57,687	67,207	73,110	173,952	589,519

* Advance buy in FY 1980 and FY 1982 with production in FY 1981 and FY 1983, respectively. Vehicles delivered only if required by delays in Shuttle development.

** Option buy. Exercise of this option dependent upon results of upper stage study.

Program Element: #35119F

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Boosters

Budget Activity Defense-wide Mission Support, #6

(U) TAILED BACKGROUND AND DESCRIPTION: The Department of Defense family of space boosters (Atlas, Thor, Titan III) was designed to provide a versatile capability (up to 29,200 pounds in low earth orbit-Titan IIIC) for meeting projected national launch requirements. While the family still includes two surplus ballistic missiles (the Atlas-E/F and Thor SM-75 vehicles), the primary boosters are considerably improved standardized versions of the original missiles. This Program Element provided for development of the Titan IIIC Space Launch Vehicle and provides continuing support for the Atlas-E/F and Titan III launch vehicles. The boosters supported by this program are:

Atlas-E/F - refurbished Atlas Intercontinental Ballistic Missile (ICBM), radio guided, liquid rocket engine, stage and one-half booster.

Titan IIIB - modified Titan II first and second stages with liquid rocket engines (core vehicle) flown with an Agena upper stage and either radio or inertial guidance.

Titan IIIC - core vehicle with a storable liquid propellant upper stage (Transtage) plus two 5 segment 120-inch diameter strap-on solid rocket motors.

Titan IIID - core vehicle with two 5 segment 120-inch diameter strap-on solid rocket motors and radio guidance.

Titan III(34)D/Inertial Upper Stage - Titan IIID modified for use with the Inertial Upper Stage; core vehicle with two 5-1/2 segment 120-inch strap-on solid rocket motors and which is guided by the Inertial Upper Stage guidance system; flown only at Cape Canaveral Air Force Station FL.

Titan III(34)D - radio guided version of the Titan III(34)D flown without the Inertial Upper Stage only at Vandenberg Air Force Base, CA.

Titan III(34)D/Transtage - Titan III(34)D flown with the Transtage replacing the Inertial Upper Stage; guidance provided by the Transtage inertial guidance system; flown only at Cape Canaveral Air Force Station, FL.

The program includes post flight analysis of Research and Development (R&D) components; study, modification, redesign and test of components as a result of deficiencies identified during vehicle systems test and flight; evaluation and improvement (where warranted) of mission reliability; component reliability improvement to prevent launch vehicle failures and analysis support and development planning for new missions. To take advantage of the investment in the Inertial Upper Stage reliability, a program was initiated in FY 1977 to correct current Titan III reliability deficiencies through the integration of the Inertial Upper Stage and its technology into the Titan III Space Launch Vehicle family. The Titan III(34)D/Inertial Upper Stage will improve the current Titan IIID, replace the Titan IIIC Space Launch Vehicles and reduce the number of nonstandard Titan III components. In addition to increasing the Titan III launch reliability, the Titan III(34)D/Inertial Upper Stage will increase Space Shuttle transition flexibility and reduce the Space Shuttle backup launch capability cost. The program provides for integration of the Transtage onto the Titan III(34)D to assure

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the ability to launch critical Department of Defense missions if the development of the Inertial Upper Stage experiences additional delays or if major technical problems are encountered in the initial Inertial Upper Stage flights. The program also provides for Atlas-E/F launches of Air Force Research and Development satellites.

(U) RELATED ACTIVITIES: Major Department of Defense and National Aeronautics and Space Administration space systems which employ the Atlas and Titan III boosters include: classified space programs; Defense Satellite Communications System, Program Element 33110F; Satellite Data System, Program Element 35158F; Defense Support Program, Program Element 12431F; National Aeronautics and Space Administration/National Oceanic and Atmospheric Administration; and NAVSTAR Global Positioning System, Program Element 64778F. This program funds modifications to the Inertial Upper Stage, which is being developed by Program Element 64411F, to allow it to be flown as an upper stage on the Titan III.

(U) WORK PERFORMED BY: Responsible Air Force agency is the Air Force Systems Command Space Division, Los Angeles, CA. Systems Engineering is provided by Aerospace Corporation, El Segundo, CA. Titan III contractors include: Martin Marietta Corporation, Denver, CO (integration, core vehicle, Transtage); Aerojet Liquid Rocket Company, Sacramento, CA (liquid propulsion system); United Technology Corporation-Chemical Systems Division, Sunnyvale, CA (solid rocket motors); Delco Electronics Division, Goleta, CA (inertial guidance); Western Electric Company, Winston Salem, NC (radio guidance) and McDonnell-Douglas Astronautics Company, Huntington Beach, CA (payload fairing). Atlas contractors include: General Dynamics - Convair, San Diego, CA (integration and airframe); Rocketdyne, Canoga Park, CA (liquid propulsion systems); General Electric, Syracuse, NY (guidance). The upper stage contractors include: Boeing Space Division, Seattle, WA (Inertial Upper Stage); McDonnell-Douglas Astronautics Company, Huntington Beach, CA (Improved Stage Vehicle System); and Lockheed Missiles and Space Company, Sunnyvale, CA (Agena). There are several additional contractors supplying Titan III and Atlas components.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Titan III program development go-ahead was received in December 1962. First launch of the Titan IIIA occurred on 1 September 1964. In 1965 the first Titan IIIC successfully placed a 21,000 pound simulated payload in orbit. The last development flight was on 23 May 1973. A reliability improvement program on the Titan III, Atlas, and Atlas-E/F boosters was initiated in FY 1973. A new guidance system for the Titan IIIC was developed and first launched on 13 December 1973. Engineering analyses and reliability improvements have included corrective action for the April 1975 Atlas-E/F failure, development of the Atlas replacement programmer, and initial development of a reliability improvement to the Atlas General Electric Radio Tracker System ground guidance hardware. In June 1977 a Congressional reprogramming authorized a program to correct reliability deficiencies in the current Titan III Space Launch Vehicle family through the use of the Inertial Upper Stage and its technology. In FY 1979 the Space Test Program Gamma Ray Spectrometer satellite was successfully launched on an Atlas-F. Through FY 1980, six NAVSTAR Global Positioning System satellites were successfully launched on Atlas-F vehicles. During FY 1980 the first three Titan III(34)D launch vehicles were delivered. The FY 1980 reliability maintenance efforts included tasks to develop shock monitors for rail transportation of Titan III solid rocket motors, to improve the reliability of the Atlas-E/F radio guidance system by

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conducting a noise analysis to determine the possibility of writing computer programs to provide backup to ground tracking antennas, and to conduct follow-up failure analysis of the Titan III 175 ampere-hour battery.

2. (U) FY 1981 Program: The Titan III(34)D/Inertial Upper Stage integration program and the basic Titan III and Atlas-E/F reliability maintenance program will continue. Integration of the Transtage onto the Titan III(34)D will be initiated. During FY 1981 planned reliability maintenance efforts include: improvement of the quality of the Titan III liquid rocket engine thrust chamber tube braze process, improvement of the accuracy of the Titan III propellant loading process, and improvement of the Titan III 4-ampere hour battery processing procedures. The effect of small launch vehicle procurements and production phase out will continue to increase problems with retaining vendors of critical components of both the Titan III and Atlas-E/F launch vehicles. This will require increased efforts to qualify new sources of existing materials/components or to redesign vehicle subsystems to incorporate replacement materials/components. Support of one Atlas-E launch for a NAVSTAR Global Positioning System Research and Development mission is planned.

3. (U) FY 1982 Planned Program: The Titan III(34)D/Inertial Upper Stage integration effort will be completed to support an Initial Launch Capability at Cape Canaveral Air Force Station, FL, in April 1982. Initial Launch Capability for the Titan III(34)D configuration at Vandenberg Air Force Base, CA, is scheduled for December 1981. Integration of the Transtage onto the Titan III(34)D will continue to support an Initial Launch Capability at Cape Canaveral Air Force Station, FL, in December 1982. The basic Titan III and Atlas-E/F reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. Support of two Atlas-E launches for NAVSTAR Global Positioning System Research and Development missions is planned. The change in FY 1982 RDT&E funds from those reflected in the FY 1981 Descriptive Summary is due to the addition of funds to integrate the Transtage onto the Titan III(34)D and to minor inflation adjustments. The FY 1982 Missile Procurement funds, which were not included in the FY 1981 Descriptive Summary, were added to provide advance buy of materials for two Titan III(34)D backup launch vehicles and to build two sets of liquid rocket engines to support maintenance of critical Titan III production capability until the Space Shuttle is operational at the Kennedy Space Center, FL (now scheduled for September 1982). Earlier efforts in this program only maintained the critical Titan III production capability until September 1981. Funds were also added in FY 1982 for an option to procure two additional Transtages with the decision to exercise this option dependent upon the results of a review of upper stage alternatives.

4. (U) FY 1983 Planned Program: The basic Titan III and Atlas-E/F reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue. Integration of the Transtage onto the Titan III(34)D will be completed. Two Atlas-E launches for NAVSTAR Global Positioning System Research and Development missions are planned. The FY 1983 Missile Procurement funds will fully fund production of two Titan III(34)D backup launch vehicles using advance buy materials procured in FY 1982. This will continue the effort to maintain critical Titan III production capability until the Space Shuttle is operational at the Kennedy Space Center, FL (now scheduled for September 1982). These two vehicles will be completed only if required by delays in the Space Shuttle development and operational availability. The FY 1983 Missile Procurement funds also support phaseout of production of certain Titan III configurations.

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5. (U) Program to Completion: The basic Titan III and Atlas-E/F reliability maintenance, flight assessment, vendor qualification, and component/subsystem replacement efforts will continue through FY 85. The program will continue to require funds from other appropriations to support operational Titan III and Atlas-E launches through FY 1985 and to phase out Titan III production.

6. (U) Milestones:

A. Start Titan III(34)D/Inertial Upper Stage Integration	June 1977
B. Space Shuttle backup launch vehicle procurement	December 1977
C. Titan III(34)D Initial Launch Capability at Vandenberg AFB, CA	December 1981
D. Titan III(34)D/Inertial Upper Stage Initial Launch Capability at Cape Canaveral AFS, FL	*(July 1981) April 1982
E. Initiate Titan III production phase down	*(October 1980) October 1982
F. Titan III(34)D/Transtage Initial Launch Capability at Cape Canaveral AFS, FL	December 1982

*Dates presented in Fiscal Year 1981 Descriptive Summaries.

EXPLANATION OF MILESTONE CHANGES: Delays in completing Inertial Upper Stage development have resulted in a delay in the Titan III(34)D/Inertial Upper Stage Initial Launch Capability at Cape Canaveral Air Force Station, FL until April 1982. No impact to payload programs is expected from this delay based on current launch schedules. Space Shuttle development delays resulted in additional actions being planned for FY 1982 - 1983 to maintain critical Titan III production capability. These actions have enabled the initiation of production phasedown to be delayed until October 1982.

Budget Activity: Defense Wide Mission Support, #6
Program Element: #35119F, Space Boosters

Test and Evaluation Data

1. (U) Development Test and Evaluation: In June 1977, the Assistant Secretary of the Air Force for Research, Development and Logistics formally approved the initiation of a program to integrate the Inertial Upper Stage into the Titan III family. This approval was based upon successful completion of a review by the Air Force Systems Acquisition Review Council of the integration program, the concurrence of the Deputy Secretary of Defense, and the prior approval of Congress of an FY 77 reprogramming request to initiate the program. Benefits projected to be derived from the Titan III(34)D/Inertial Upper Stage Integration were: increased reliability, increased payload capability, reduction in launch vehicle configurations, mission model flexibility, and reduced total program cost. The Air Force Systems Command Space Division is responsible for management of the Titan III(34)D/Inertial Upper Stage integration program. Participating contractors are: (1) Martin-Marietta Denver Aerospace Company, Denver, Colorado; Boeing Aerospace Division Seattle, Washington; Chemical Systems Division of United Technologies, Sunnyvale, California; Aerojet Liquid Rocket Company, Sacramento, California; and McDonnell-Douglas Astronautics, Huntington Beach, California. The Arnold Engineering Development Center, Tullahoma, Tennessee, provides test support to this program.

(U) Testing of Titan III changes required to integrate the Inertial Upper Stage into the Titan III Space Launch Vehicle family consists of structural and electronic ground testing. Structural test provisions include testing of all new and modified hardware. Structural test items for this configuration include a modified Stage II equipment truss, a new design Stage II adapter skirt, an additional solid rocket motor half-segment, a new design Titan III(34)D-to-Inertial Upper Stage support truss, and a modified payload fairing. Additional structural testing will also be required on the existing Stage I long core section. Tests of the Inertial Upper Stage avionics/Titan III(34)D electronics interface will be required to insure system compatibility. Inertial Upper Stage separation and shock testing will be provided to insure Inertial Upper Stage compatibility with the Titan III interface. The Failure Modes and Effects Analysis for the Titan III will be updated to reflect all changes resulting from the Titan III(34)D/Inertial Upper Stage integration.

(U) Inertial Upper Stage separation and shock testing was completed in November 1978 and demonstrated that the actual shock spectrum was less than predicted. The Titan III(34)D/Inertial Upper Stage configuration structural qualification testing was initiated in April 1980 and was completed in September 1980. In October 1979, the second and last full-scale static firing of the 5-1/2 segment, 120-inch diameter Solid Rocket Motor was successfully completed, demonstrating the flight-worthiness of the 5-1/2 segment motor and the new nozzle throat material. In April 1979, the Stage I fuel tank tests were successfully completed, thus verifying that the "stretched" Stage I fuel tank used on the Titan IIIB can withstand the Titan III(34)D/Inertial Upper Stage flight environment. Successful completion of payload fairing separation tests has verified proper separation of the modified payload fairing from the vehicle. Joint Titan III(34)D/Inertial Upper Stage electronics interface testing is scheduled in 1981.

(U) Development of the Inertial Upper Stage under Program Element 64411F continues. The Inertial Upper Stage program entered full scale development in March 1978 with Initial Launch Capability for the Inertial Upper Stage for

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both the Shuttle and Titan III applications scheduled for July 1980. However, technical problems during the development resulted in delay in the Initial Launch Capability for the Titan III(34)D/Inertial Upper Stage from July 1980 to July 1981. Critical Design Review of the Inertial Upper Stage was initiated in February 1979 and completed in November 1979.

(U) Inertial Upper Stage propulsion system development testing is proceeding rapidly. To date, seven solid rocket motor cases have been burst tested and four cases have been skirt tested. Preliminary results were below design criteria, but additional wraps on the case have produced adequate margin. Two burst and two skirt tests remain to be completed. Nine Inertial Upper Stage motors have been fired at the Arnold Engineering Development Center. All have been successful and have achieved nominal performance values. These include four large first stage (Solid Rocket Motor-1) and five small second stage (Solid Rocket Motor-2) motors. One motor firing included the Extendable Exit Cone, which was deployed prior to the firing. Three motors remain to be fired in the development test program which should be complete in March 1981. Twelve additional motors (six Solid Rocket Motor-1 and six Solid Rocket Motor-2) will be fired for the qualification test program. These firings will begin after completion of development testing and continue through December 1981. Motors required for Titan III(34)D qualification will be fired by October 1981. Currently the major technical problem remaining open in the propulsion area is cracking of the propellant in the boot area of the solid rocket motor, which has been observed on four motors. The probable cause of this cracking has been identified, and a proposed solution involving better propellant processing control and a slight modification to the boot has been formulated. This fix will be confirmed by X-rays of four qualification motors (two of each size) prior to casting the first flight motor. Early in the program, there were problems with motor case manufacturing and process control. These problems were not technical, but rather were problems of manufacturing process control, quality control, etc., and have been satisfactorily resolved.

(U) Vehicle structural tests with the Inertial Upper Stage development test vehicle have been completed for the Titan III(34)D configuration. Test results were used to verify math structural models of the vehicle which will be used to verify local environments caused by acoustics and pyro staging/separation elements. Qualification tests of the separation devices have been completed. Qualification of ten other vendor structural components is scheduled for completion by the end of the first quarter of calendar year 1981. Structural tests on the Titan III(34)D configuration Inertial Upper Stage vehicle (one of the three configurations of flight vehicles) began in May 1980. Test set-ups for the Space Transportation System and National Aeronautics and Space Administration three stage configuration are scheduled to be completed in March 1981.

(U) Component qualification testing of avionics line replaceable units for the Inertial Upper Stage (Titan III(34)D application) is in progress with 10 of 40 line replaceable units in test. Thirty line replaceable units, including the flight computer have completed qualification. Minor design problems have been encountered during testing under the severe pyro shock and acoustic vibration environments. Solutions have been incorporated by improved packaging of the parts within the units. It should be noted that the high reliability piece parts chosen for the Inertial Upper Stage have performed well during qualification testing. Avionics line replaceable units qualification

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Budget Activity: Defense Wide Mission Support, #6
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is scheduled to be completed by March 1981. Completion of systems level qualification tests is delayed from February 1981 to July 1981, primarily due to late delivery of avionics components.

(U) Titan III(34)D/Inertial Upper Stage flight software continues to be a pacing item. The flight software is being developed by TRW and tested at the Boeing Aerospace facility in Kent, WA. The prototype flight software has been designed, coded, and tested. The Operational Flight Software development continues with coding accomplished by TRW and with code modules now in integration testing at TRW (to be followed by verification and validation testing at Boeing Aerospace Systems Integration Laboratory). The independent verification and validation by the Martin Marietta Corporation will start in March 1981 and be complete in April 1982. The Mission Data Loads generation process is in a preliminary stage and is tailored for the first mission which will fly on the Titan III(34)D launch vehicle with a Department of Defense payload. Completion of the Operational Flight Software development and validation will not occur in time to support the July 1981 Titan III(34)D/Inertial Upper Stage Initial Launch Capability Air Force Systems Acquisition Review Council threshold date, but is now projected for April 1982.

(U) On 7 October 1980 Boeing formally notified the Air Force of their inability to meet the July 1981 revised Initial Launch Capability date for the Inertial Upper Stage. The major factors causing this latest delay are those previously discussed, namely: the propellant cracking problem, delayed avionics components deliveries causing late components and system level qualification testing completion, and delayed software deliveries. The projected Titan III(34)D/Inertial Upper Stage Initial Launch capability is April 1982. This delay (April 1982) is not expected to cause any serious launch problems based upon current schedules.

2. (U) Operational Test and Evaluation: Since the Titan III/Inertial Upper Stage is not scheduled for operational employment, no operational test and evaluation program is planned. Currently only thirteen Titan III(34)D vehicles are planned for delivery; the first delivery was in December 1979. Eight of these vehicles will be used for prime launches (five with Inertial Upper Stages) and five will be Space Shuttle backups. Dependent on Space Shuttle development schedules, two additional backups may be delivered. Post-flight data from launches of these vehicles will be analyzed to determine if any modifications to the vehicle configuration are required to correct problems which may occur in flight.

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Budget Activity: Defense Wide Mission Support, #6
 Program Element: #35119F, Space Boosters

3. (U) System Characteristics:

	<u>OBJECTIVE</u>	<u>CURRENT ESTIMATE</u>
Low Earth Orbit Missions (No Inertial Upper Stage) Payload Capability (pounds) 100 nautical mile (East)-10 foot Payload Fairing Cape Canaveral Air Force Station, Florida	32,900	32,900
100 nautical mile (polar)-10 foot Payload Pairing Vandenberg Air Force Base, California	27,600	27,600
Synchronous equatorial orbit missions Payload Capability (pounds) 10 foot Payload Pairing Cape Canaveral Air Force Station, Florida	4,000	4,000
Reliability	97%	97%

NOTE: (U) Due to the development of the Titan III(34)D from the existing Titan III family and the small number of systems, availability and maintainability objectives have not been specified for the Titan III(34)D.

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35130F

Title: Consolidated Space Operations Center
Budget Activity: Defense-wide Mission Support, #6

DOD Mission Area: Space Launch and Orbital Control, #410

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
			8,700	19,900	23,400	58,600	110,600
TOTAL FOR PROGRAM ELEMENT							

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Consolidated Space Operations Center (CSOC) consists of two elements: the Satellite Operations Complex (SOC) and the Shuttle Operations and Planning Complex (SOPC). The need for these satellite control capabilities is based on the vulnerability of the Satellite Test Center in Sunnyvale, CA, a single node in the satellite control network which provides tracking, telemetry, and command capabilities to satellites supporting various national security missions. The SOC is vulnerable to both environmental (earthquake) and manmade threats and has limited growth potential. The need for the Shuttle control capability stems from the planned increase in use of the Space Shuttle for DOD missions. The Air Force program for the next several years includes a number of important DOD Shuttle missions, most requiring close coordination with the satellite control network. The DOD Shuttle control capability at Johnson Space Center (JSC) does not meet all DOD requirements for planning and conducting DOD missions. CSOC overcomes these limitations by providing a secure dedicated facility from which to conduct DOD space missions; the siting criteria minimizes environmental and man made threats; adequate capacity to support the national shuttle traffic model is obtained; and direct DOD control of military space operations is achieved.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The FY 1982 request reflects the Air Force decision to delay the military construction start until FY 1983 thereby slipping the IOC until 1986. FY 82 effort will focus on detailed integration planning, systems engineering and upgrade analysis to adapt existing NASA equipment to meet CSOC requirements. The increase in RDT&E funding in FY 1982 when compared to the 1981 Descriptive Summary reflects a better understanding of the magnitude of the CSOC integration and acquisition planning tasks and the work needed to develop CSOC unique internal and external interfaces. The RDT&E request is based on estimates provided by HQ AFSC.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
RDT&E		13,700	6,400		45,700	65,800
Procurement (Other)			89,836		138,467	228,343
Military Construction			109,000			109,000

(U) OTHER APPROPRIATION FUNDS:

Procurement (Other)
Military Construction
Operations and Maintenance

112,102
117,302
2,299

130,068
29,000
Continuing

242,170
146,302
Not Applicable

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35130F

DOD Mission Area: Space Launch and Orbit Control, #410

Title: Consolidated Space Operations Center

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Consolidated Space Operations Center (CSOC) will combine into a single facility a satellite operations capability and the DOD Shuttle control capability, establishing a DOD facility for conducting both DOD satellite and Shuttle support operations. The Satellite Operations Segment will share the normal satellite support workload with the Satellite Test Center. If either becomes inoperative for any reason, the remaining Center will assume full responsibility for the satellite programs. The Shuttle Control Segment of CSOC will be designed to perform all DOD Shuttle operations with the interim DOD capability at the Johnson Space Center (JSC) remaining as an emergency backup. The extensive coordination required between the CSOC segments will benefit from a common location. In addition, important cost savings will result by the use of such common facilities as security, logistics and support, antennas and communication links.

(U) RELATED ACTIVITIES: The Satellite Operations Complex (SOC) of the CSOC will become an integral part of the Satellite Control Facility (SCF) network, funded under PE 35110F. The Data System Modernization project for the SCF contains contractual options to provide the SOC satellite control complement of equipment. The Shuttle Operations and Planning Complex (SOPC) will expand the DOD Shuttle control capabilities now being established as the JSC Controlled Mode under PE 63411F and 64411F and provide an autonomous DOD capability. The SOPC complement of equipment will be based on the systems developed at Johnson Space Center.

(U) WORK PERFORMED BY: Air Force management of the CSOC development and acquisition effort is under the Space Division, Los Angeles AFS, CA. No major CSOC contracts have been awarded.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 AND PRIOR ACCOMPLISHMENTS: The FY 1979 CSOC efforts dealt principally with requirements validation and concept development. A joint DOD/NASA study of various satellite operations/Shuttle control configurations was done for Office of Management and Budget. Mission Element Need Statements for SOC and SOPC were validated by the Secretary of Defense in September 1979. Site surveys were conducted and the Peterson AFB/Colorado Springs, CO, area was tentatively selected as the CSOC site pending completion of environmental impact analyses.

2. (U) FY 1981 PROGRAM: CSOC work during FY 1981 includes development of detailed functional requirements, facilities design criteria, and initiation of facilities design. Development of an acquisition business strategy and initial system integration planning will also occur in FY 1981. Reduction in the FY 1981 effort from the 1981 estimate was the result of undistributed Congressional reduction in the RDT&E account. This reduction is consistent with the decision to delay the Initial Operating Capability until 1986.

3. (U) FY 1982 PLANNED PROGRAM: During FY 1982 the design refinement, acquisition planning and interface definition work started in FY81 will continue. Requirements development/definition for each of the functional areas will be conclude Implementation planning and integration work will address such items as acquisition planning, engineering trade studies, life cycle cost analyses, schedule planning, and interface control documentation. Also planned are studies to determine how best to adopt the existing NASA and Air Force system to CSOC applications. Facility design work will be completed.

Program Element: #35130F

DOD Mission Area: Space Launch and Orbit Control #410

Title: Consolidated Space Operations Center

Budget Activity: Defensewide Mission Support #6

4. (U) FY 1983 PLANNED PROGRAM: The facility construction will begin in FY 1983. During FY 1983 the acquisition of elements of the technical equipment will begin.

5. (U) PROGRAM TO COMPLETION: FY 1984 thru FY 1986 will continue hardware acquisition and software development for technical system and communications. Initial Operating Capability is planned for mid-FY 1986.

6. (U) Milestones:

A. Mission Element Need Statements Validated	September 1979
B. Preliminary Site Selection (pending environmental impact process)	December 1979
C. Environmental Impact Analysis Filed	March 1981
D. Military Construction Program Submission (35% design complete)	January 1982
E. Military Construction Program Approval	October 1982
F. Start Construction	March 1983
G. Initial Operating Capability	June 1986

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FY 1981 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35160F Title: Defense Meteorological Satellite Program
 DOD Mission Area: Global Military Environmental Support, #420 Budget Activity: Defense Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	
	TOTAL FOR PROGRAM ELEMENT	17,880	19,000	48,300	38,700	Continuing	Not Applicable	

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Defense Meteorological Satellite Program is an advanced weather satellite system which provides visual and infrared cloud cover data and other meteorological, oceanographic, and solar-geophysical information. These data are required over the entire surface of the earth in support of strategic and tactical missions. Two satellites are required in polar orbit at all times; one providing data in the early morning and early evening, the other during mid-day and mid-night.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The program provides for the modification of the current satellite and primary sensor for launch from the Shuttle in FY 1986. It also provides for development of the Block 5D flight simulation facilities, command and control system, and the satellite data handling system which will improve the quality of primary data available to satisfy mission requirements. Funding amounts are based on Air Force System and contractor cost estimates for development, production, and operation and maintenance.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980		FY 1981		FY 1982		FY 1983		Additional to Completion		Estimated Costs	
			Estimate		Estimate		Estimate		Continuing		Not Applicable	
RDT&E		15,900	19,000		62,300		21,101		Continuing		Not Applicable	
Missile Procurement		21,600	42,719		21,101		9,448		Continuing		Not Applicable	
Other Procurement		3,459	4,056		9,448				Continuing		Not Applicable	

(U) OTHER APPROPRIATION FUNDS:

Missile Procurement (Quantity) (Satellite)	25,400	43,355	37,956	37,007	Continuing	Not Applicable
Other Procurement	(p)	(1)	(p)	(p)	Continuing	Not Applicable
Operation and Maintenance	4,033	4,145	1,900	6,860	Continuing	Not Applicable
	1,240	9,742	13,893	15,729	Continuing	Not Applicable

Program Element: #35160F

Title: Defense Meteorological Satellite Program
DOD Mission Area: Global Military Environmental Support, #420 Budget Activity: Defense Wide Mission Support, #6

DETAILED BACKGROUND AND DESCRIPTION: The Defense Meteorological Satellite Program is a weather satellite system started by the Air Force in to provide daily cloud cover data from the, and the system has been continuously operational since that time. The first successful launch was in and the system has been continuously operational since that time. In 1965, weather support to tactical operations was initiated when a mobile van which could receive direct, real-time weather data was deployed to South Vietnam. A requirement exists for two satellites in orbit. The orbits are circular, sun-synchronous, near-polar, at 450 nautical miles altitude, with a period of 101.6 minutes. Launch is from Vandenberg Air Force Base, CA, using an Atlas launch vehicle. Stored data are recorded on the satellites and later sent to one of the data receiving stations at either Fairchild Air Force Base, WA, Loring Air Force Base, ME, or Kaena Point, HI, where it is simultaneously relayed via commercial satellite to the Air Force Global Weather Central at Offutt Air Force Base, NE, and Fleet Numerical Oceanographic Center, Monterey, CA, for use in strategic and tactical weather forecasting. Real-time data are also transmitted to tactical receiving terminals located worldwide. Fixed tactical terminals are located in Hawaii, Kwajalein missile range, Guam, the Philippines, and Cape Canaveral, Florida. The fixed tactical terminal at Hickam Air Force Base, HI, receives real-time weather pictures of the eastern and central Pacific for monitoring typhoons and planning classified operations. Mobile tactical receiving terminals are located in Korea, Japan, Alaska, Panama, the Philippines, and Germany. Three Mark IV mobile tactical terminals are now available for instant deployment to any crisis area. Direct links have been installed from Air Force Global Weather Central to Headquarters Tactical Air Command and the Pentagon to provide data on a timely basis to the Commander, Tactical Air Command, and the Joint Chiefs of Staff.

(U) RELATED ACTIVITIES: The Defense Meteorological Satellite Program is a joint-Service program in accordance with the Memorandum of Agreement on Joint Service Management and Operations, dated 15 December 1976. The program provides support to all military services. Based on the successful operation of an experimental receiving terminal aboard the U.S.S. Constellation, the Navy is equipping all large carriers to receive data and is operating two shore based terminals to receive data. The Air Force began procurement of new low cost tactical terminals in FY 1978, and the other services will begin procurement in following years. Navy personnel are integrated into the Program Office to insure compatibility between the Air Force satellites and the receiving and data processing equipment of the Navy. Personnel from the Army's Atmospheric Sciences Lab are coordinating Army matters with the Program Office. Close coordination is also maintained with the civilian weather satellite program, operated by the Department of Commerce. The two systems have different primary missions and different primary sensors. Cloud imagery is the primary Defense need while vertical temperature soundings are the primary Commerce need. Interchange of technology has been continuous, with special emphasis on avoiding duplication of effort. Pursuant to a study directed by the Office of Management and Budget, Commerce decided in January 1974, to adopt the Defense spacecraft, the Block 5D, as a basic spacecraft bus for the civil system.

Program Element: #35160F

DOD Mission Area: Global Military Environmental Support, #420 Title: Defense Meteorological Satellite Program
Budget Activity: Defense Wide Mission Support, #6

(U) WORK PERFORMED BY: Development and procurement are managed by the Space Division, Los Angeles, CA. The Air Force Geophysics Laboratory, Bedford, MA, the Wright Aeronautical Laboratories, Wright-Patterson AFB, OH, Air Force Weapons Laboratory, Kirtland AFB, NM, the Aerospace Corporation, El Segundo, CA, and the Navy's Environmental Prediction Research Facility, Monterey, CA, all contribute to the DMSP satellite meteorology development program. Contractors include: RCA, Princeton, NJ - spacecraft; Westinghouse Electric Corporation, Baltimore, MD - sensor and ground display equipment; Barnes Engineering Company, Stamford, CT, and Aerojet Electro Systems, Azusa, CA - special sensors; Harris Corp., Melbourne, FL - ground terminals; General Dynamics - Convair, San Diego, CA - launch vehicle; Hughes Aircraft Company, Los Angeles, CA - special sensor, microwave imager.

PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. FY 1980 and Prior Accomplishments: In addition to continuous support of the special strategic missions, Defense Meteorological Satellite Program provided emergency support during the
Pueblo crisis (1968), all of the Apollo and Skylab recoveries (1969-1974),
and the Mayaguez ship recovery operation (1975). Use of the real-time tactical data in Southeast Asia was highly successful; for example, weather forecasts based on Defense Meteorological Satellite Program data reduced the number of weather ineffective RF-4C sorties in Cambodia by 66% in 1973. The mission of the Defense Meteorological Satellite Program is to provide the United States Armed Forces with visual and infrared weather data of unmatched quality, timeliness, usability, and flexibility. During 1966-1980, the program achieved 22 successful launches in 25 attempts, using refurbished surplus Thor boosters. In 1972, the Air Force began the development of a more reliable and producible system, designated the Block 5D integrated spacecraft. This effort continued during FY 1973-1977 and the first Block 5D satellite was launched on 11 September 1976. Efforts to extend the on-orbit life of Defense Meteorological Satellite Program satellites from two to three years were completed in 1978. A ground system upgrade was initiated in 1978 and in 1979 the decision was made to use the ATLAS launch vehicle for launches in 1981 and beyond.

Plans for development of an optimized satellite for Shuttle launch were cancelled following Presidential Directive 54 which directed Department of Commerce and Defense and National Aeronautics and Space Administration to retain separate military and civil meteorological satellite programs until a major new development effort was required. A major new satellite system would have to be developed jointly. The Air Force instead chose to retain the current (Block 5D-2) satellite configuration and make those modifications required for a successful launch using Space Shuttle. This Shuttle version was designated Block 5D-3.

Program Element: #35160F

Title: Defense Meteorological Satellite Program

DOD Mission Area: Global Military Environmental Support, #420

Budget Activity: Defense Wide Mission Support, #6

2.(U) FY 1981 PROGRAM: Begin modification of a 5D-2 satellite (current configuration of the satellite) for launch using Shuttle by FY 1986. Development of a Block 5D flight simulation facility will continue and the Block 5D-2 command and control system development will be completed.

3.(U) FY 1982 PROGRAM: Continue efforts to modify a 5D-2 satellite for launch using Shuttle by FY 1986. Acquire primary sensor for the modified 5D-2 satellite. Continue development of an ionospheric sensor. Develop procedures for encryption of command and telemetry links. System engineering and systems analysis efforts will be pursued and one satellite is currently scheduled for launch. FY 1982 estimates changed from last year's submission because of Presidential Directive 54 as explained at the end of paragraph 1.

4.(U) FY 1983 PROGRAM: Continue efforts to modify a Block 5D-2 satellite for launch using Shuttle by FY 1986. Acquire satellite bus for the modified 5D-2 satellite. Modify ground systems to support Shuttle launch.

5.(U) PROGRAM TO COMPLETION: RDT&E funding will allow evolutionary development of spacecraft and sensors as necessary to support new requirements of the special strategic missions, the Joint-Service mission, and the Joint Chiefs of Staff. This is a continuing program.

6.(U) MILESTONES:

	<u>Date</u>
A. Program Initiation	
B. (U) Contract Award for Block 5D Satellite	Feb 1972
C. (U) Deliver First Block 5D with Sensor Complement	3Q FY 1976
D. (U) First Launch of Block 5D Satellite	11 Sep 1976
E. (U) First Launch of extended life Block 5D Satellite	Dec 1981
F. (U) Contract for Shuttle launch capability modifications	Aug 1981
G. (U) First Launch using Shuttle	Mar 1986

Budget Activity: Defensewide Mission Support #6
 Program Element: 35160F, Defense Meteorological Satellite Program

Test and Evaluation Data

1. (U) Development Test and Evaluation: RCA Corporation is the prime development contractor for the Defense Meteorological Satellite Program. All Development Test and Evaluation on the baseline design has been completed. System Development Test and Evaluation included static loads testing, acoustic and vibration testing, temperature cycling and thermal vacuum testing, orbit simulation testing in the vacuum chamber, simulated launch functional testing, and numerous detailed electrical tests both before and after environmental test events. Prior to system level testing, all components and subsystems underwent detailed functional and environmental tests. The hardware used for Development Test and Evaluation was designed and built as flight equipment. As a result of Development Test and Evaluation, design changes were made to the sensor mounting platform structural members, the solar array deployment mechanism, the satellite thermal control system, and the central computer internal design.

2. (U) Operational Test and Evaluation: The Defense Meteorological Satellite Program is continually evolving as meteorological satellite technology advances. The current acquisition efforts for Block 5D-2 satellites and the supporting ground system changes are part of this continuing evolution. The changes and modifications are tested through the development process, prior to the launch of new satellites. Hence, as an operational system under continuous upgrade, no identifiable operations test and evaluation requirements currently exist. Based on a review of future plans, no Air Force Test and Evaluation Center managed/monitored Operational Test and Evaluation is required at this time.

3. (U) System Characteristics:

	<u>Objectives</u>	<u>Demonstrated</u>	
		<u>Development Test and Evaluation</u>	<u>Operational Test and Evaluation</u>
Orbit	450+ 9 Nautical Miles Circular	400 Minutes	450+ 5 Nautical Miles
Data Storage Capacity		400 Minutes	400 Minutes
Imagery Resolution	.3 and 1.5 Nautical Miles, Visual and Infrared	.25 and 1.5 Nautical Miles, Visual and Infrared	.25 and 1.5 Nautical Miles, Visual and Infrared

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #35171F

Title: Space Launch Support

DOD Mission Area: Space Launch and Orbital Support, #410

Budget Activity Defense-wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT		26,462	39,700	TBD	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides the Space Transportation System resources/capability needed to transport Air Force space payloads into their mission orbits. The main program objective is to provide consolidated management, programming, and execution of the operational phase Air Force Space Shuttle/Inertial Upper Stage/Payload Assist Module-Delta class activities that are common to the Department of the Air Force research and development and operational satellite programs.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Provides funds for payment of the Orbiter Flight Charge for the launch of the Space Test Program Teal Ruby mission on the Space Shuttle. Provides funds for one Payload Assist Module-Delta class and for reimbursement to the National Aeronautics and Space Administration of the development costs for incorporating communications security capability in the Tracking and Data Relay Satellite System. Calculation of the Orbiter Flight Charge was made using the fixed rate established in the National Aeronautics and Space Administration/Department of Defense Memorandum of Agreement. The price of the Payload Assist Module-Delta class was derived from the contractor's pricing manual.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981	FY 1982	FY 1983	Additional to Completion	Total Estimated Costs
RDT&E						
Procurement (Missile)	25,905	3,433	35,033		Continuing	Not Applicable
		709	29,502		Continuing	Not Applicable

Program Element: #35171F

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Launch Support
Budget Activity Defense-wide Mission Support, #6

(U) OTHER APPROPRIATION FUNDS:

	<u>FY 1980</u>	<u>FY 1981</u>	<u>FY 1982</u>	<u>FY 1983</u>	<u>Additional</u>	<u>Total</u>
	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>Estimate</u>	<u>to Completion</u>	<u>Estimated</u>
						<u>Costs</u>
Procurement (Missile)	21,905	710	33,575	86,648	Continuing	Not Applicable*
(Quantity)						
(Inertial Upper Stages)	(1)	(0)	(1)	(1)	Continuing	
(Payload Assist Modules-Delta class)	(0)	(0)	(0)	(8)	Continuing	
Operation and Maintenance	1,364	30,875	68,702	150,233	Continuing	Not Applicable
Military Personnel	644	1,558	2,250	3,912	Continuing	Not Applicable

*Includes initial spares.

Program Element: #35171F

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Launch Support

Budget Activity Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: This program element provides the Space Shuttle/Inertial Upper Stage/Payload Assist Module-Delta class support that is common to the Department of the Air Force research and development and operational satellite programs. This support includes procurement of Inertial Upper Stages, Payload Assist Modules-Delta class, and their associated launch services; payment of Orbiter Flight Charges to the National Aeronautics and Space Administration; provision of mission control operations and recurring payload integration; and operation of the national Space Shuttle launch site at Vandenberg Air Force Base, CA. The research and development satellite programs supported include the Space Test Program, Program Element 63402F; and the first Space Shuttle mission of each of the following programs: Space Based Surveillance System, Program Element 63428F; the Defense Meteorological Satellite Program, Program Element 35160F; and the Air Force Satellite Communications System, Program Element 33601F. The operational satellite programs supported are the Defense Meteorological Satellite Program, Program Element 35160F; the Defense Satellite Communications System, Program Element 33110F; the Defense Support Program, Program Element 12431F; the NAVSTAR Global Positioning System, Program Element 35165F; the Satellite Data System, Program Element 35158F; the Space Based Surveillance System, Program Elements 63428F and 12424F; and the Air Force Satellite Communications System, Program Element 33601F.

(U) RELATED ACTIVITIES: The Inertial Upper Stage development, Department of Defense Space Shuttle operations capability development, and the acquisition of the Vandenberg Air Force Base Shuttle launch site are being accomplished in PE 64411F and PE 12449F. The individual Air Force programs will provide resources for program unique launch hardware and/or services. The resources for support to other Department of Defense programs are included in the appropriate Special Activity and Department of the Navy Program Elements.

(U) WORK PERFORMED BY: The responsible Air Force agency is the Air Force Systems Command's Space Division, Los Angeles, CA. Systems engineering is provided by the Aerospace Corporation, El Segundo, CA. The Inertial Upper Stage and spacecraft integration contractor is the Boeing Aerospace Company, Seattle, WA. The Payload Assist Module-Delta class contractor is the McDonnell-Douglas Astronautics Company, Huntington Beach, CA. The payload integration contractor is Martin Marietta Corporation, Denver, CO. The Vandenberg Air Force Base Shuttle operations contractor has not been selected. The National Aeronautics and Space Administration is the Space Transportation System manager and operates the national Space Shuttle eastern launch site at Kennedy Space Center, FL, and the mission control center at Johnson Space Center, TX.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Not Applicable
2. (U) FY 1981 Planned Program: Reimbursement will be made to the National Aeronautics and Space Administration for the development costs for incorporating communications security capability in the Tracking and Data Relay Satellite System.
3. (U) FY 1982 Planned Program: Payment of the Orbiter Flight Charge for the launch of the Space Test Program Teal Ruby mission on the Space Shuttle will be made. Purchase of one Payload Assist Module-Delta class will be made. Reimbursement will be made to the National Aeronautics and Space Administration for the development costs for incorporation communications security capability in the Tracking and Data Relay Satellite System. The net increase in FY 1982

Program Element: #35171P

DOD Mission Area: Space Launch and Orbital Support, #410

Title: Space Launch Support

Budget Activity Defense-Wide Mission Support, #6

RDT&E funds from those reflected in the FY 1981 Descriptive Summary reflects deletion of procurement of one Inertial Upper Stage due to the decision made to launch the NAVSTAR Global Positioning System satellites using the Payload Assist Module-Delta class rather than the Inertial Upper Stage and addition of funds to reimburse the National Aeronautics and Space Administration for communications security on the Tracking and Data Relay Satellite System. The change in FY 1982 Missile Procurement funds from those included in the FY 1981 Descriptive Summary reflects the inclusion of spares to support Airborne Support Equipment, Interface Verification Equipment, and the Vandenberg Air Force Base Launch Processing System.

4. (U) FY 1983 Planned Program: Payment of the Orbiter Flight Charge and mixed cargo integration charges to support a Space Test Program sortie mode mission on the Space Shuttle in Fiscal Year 1984 will be made. Reimbursement will be made to the National Aeronautics and Space Administration for the development costs associated with incorporating communications security capability in the Tracking and Data Relay Satellite System.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #78019F

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Utah Test and Training Range
Budget Activity: Defensewide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
TOTAL FOR PROGRAM ELEMENT		2,300	1,780	12,000	15,300	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program provides resources for the development of new instrumentation, the procurement of off the shelf equipment and instrumentation, and the operations and maintenance of the Utah Test and Training Range. The range supports development testing of cruise missiles, unmanned vehicles, and airborne parachute recovery systems. It also supports airborne tactical training for active and reserve units, and provides scenarios for large scale operational exercises.

(U) BASIS FOR FY 1982 RDT&E REQUEST: The program includes funds for a major range upgrade to preserve the option to conduct an Advanced Medium Range Air-to-Air Missile (AMRAAM) operational utility evaluation and for equipment and instrumentation necessary to support the RDT&E mission, such as communication system modernization. Cost estimates are based on detailed engineering evaluations and, where available, manufacturer's cost quotes for the same or similar equipments.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
RDT&E	1,700	1,800	1,900		Continuing	Not Applicable
Other Procurement	800	3,285	2,739		Continuing	Not Applicable

(U) OTHER APPROPRIATION FUNDS:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
Other Procurement	803	3,358	2,864	1,045	Continuing	Not Applicable
Military Construction	740				Continuing	Not Applicable
Operation and Maintenance	6,681	11,283	12,573	13,260	Continuing	Not Applicable

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Program Element: #78019

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Utah Test and Training Range

Budget Activity: Defensewide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Utah Test and Training Range (UTTR) is located in western Utah and consists of 2.9 million acres of controlled airspace. The range supports test and evaluation of Air/Ground Launched Cruise Missiles (ALCM/GLCM), Remotely Piloted Vehicles (RPV), and parachute recovery systems; Tactical Air Command combat crew training; Air Force Logistics Command aircraft and munitions tests; Air Force Test and Evaluation Center (AFTEC) operational test and evaluation; and training for the Air Force Reserves. The RDT&E funds are used to improve and modernize the range instrumentation used for gathering telemetry, optical and metric data for range users. Other Procurement funds are used for the procurement of off the shelf equipment and instrumentation. Range operation and maintenance is funded from the Operations and Maintenance appropriation.

(U) RELATED ACTIVITIES: The Utah Test and Training Range supports DoD programs and those of other government agencies. The majority of the workload is performed under contract (60 percent). The funding source for this contract is the Operations and Maintenance appropriation.

(U) WORK PERFORMED BY: The Utah Test and Training Range is managed and operated by the Air Force Systems Command's 6501st Range Squadron at Hill AFB, UT. Procurement and contract management support is provided by the Air Force Systems Command's Air Force Flight Test Center at Edwards AFB, CA. In addition to a major range upgrade to preserve the option to conduct the Advanced Medium Range Air-to-Air Missile (AMRAAM) operational utility evaluation, the RDT&E appropriation will be used to fund 17 technical equipment improvement contracts in FY 1982, the largest of which is anticipated to be less than \$350,000. The contracts will be released for bid in FY 1981. Potential contractors for the major range upgrade will not be known until bid responses are received in late FY 1981 or early FY 1982.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: On January 1, 1979 Air Force Systems Command became the single range manager. Effective 1 October 1979, the UTTR was placed within the purview of Department of Defense Directive 3200.11, the directive which governs the use, management and operation of major DoD ranges and test facilities. Funding for range operation was through Operations and Maintenance appropriations. RDT&E funds were used to upgrade capabilities of the mission control center, range instrumentation, data transmission and communications.
2. (U) FY 1981 Program: RDT&E funds will be used to continue the upgrade of the range mission control center and microwave system. Additional range capability upgrades using RDT&E funds will include mobile C-band radar systems, flight test television modernization, and intercept tracking system.
3. (U) FY 1982 Planned Program: RDT&E funds will be used to continue the range upgrade into FY 1982. FY 1982 upgrades include the modernization of the communication system and the continuation of the intercept tracking system. The FY 1982 RDT&E funding level has been increased by \$10 million to provide long lead items and major range improvements to preserve the option to conduct the flight test portion of the Advanced Medium Range Air-to-Air Missile (AMRAAM) operational utility evaluation.

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Program Element: #78019F

DoD Mission Area: Major Ranges and Test Facilities, #451

Title: Utah Test and Training Range

Budget Activity: Defensewide Mission Support, #6

4. (U) FY 1983 Planned Program: RDT&E funds will be used to continue the upgrade of the mission control center and communication system and for the modernization of range instrumentation. RDT&E funds will also be used to continue the range improvements for the AMRAAM operational utility evaluation.
5. (U) Program to Completion: This is a continuing program.
6. (U) Milestones: Not applicable

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FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #78026F

DoD Mission Area: Defense System Cost

Effectiveness/Improvement, #473

Title: Productivity, Reliability, Availability
and Maintainability (PRAM)

Budget Activity: Defense wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING): (\$ in thousands)

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion	Total Estimated Costs
	TOTAL FOR PROGRAM ELEMENT	5,900	8,600	9,400	10,200	Continuing	Not Applicable

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: The Air Force has an urgent need to reduce the rising cost of ownership and improve productivity, reliability, availability and maintainability of its operational systems. The office of the Secretary of Defense FY 1981-1985 Consolidated Guidance stated, "We have learned that it is virtually impossible to anticipate and solve all reliability problems in a complex weapon system before it is fielded. In order to realize the intended performance from a system, one must plan to improve the design with reliability and maintainability modification throughout most of its service life." Productivity, Reliability, Availability and Maintainability has continued to respond forcefully to fill this major gap for programs, since its inception in 1975 by the Air Force Chief of Staff, through judicious and timely investments in projects leading to lower life cycle costs and improved operational readiness. The need for continuing this vital program has been documented over the years by commanders of both Air Force Systems Command and Logistics Command, and has been underscored by the Assistant Secretary of Air Force for Research, Development and Logistics as well as the Under Secretary of Defense for Research and Engineering.

(U) BASIS FOR FY 1982 RDT&E REQUEST: This program provides investment funds for projects leading to reduced cost of ownership or enhanced force readiness in the areas of airframes, avionics, propulsion (non-Component Improvement Program applications affecting logistics support, repair technology and test methods that impact more than one engine model), missile, depot maintenance and other support areas. Specific projects to be funded will be formulated by the Productivity Reliability, Availability and Maintainability Program Office and its affiliated field offices. Selection of projects will be based on such criteria as risk, projected cost, return initiatives (i.e., readiness, mobility, fuel conservation) and return on investment within the scope of our Charter. Projects selected for investment will continue to stand audit during the amortization period. This is a level of effort program.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional To Completion Continuing	Total Estimated Costs
RDT&E	5,900	8,592	9,145			N/A

(U) OTHER APPROPRIATION FUNDS: Not Applicable.

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Program Element: #78026F

DoD Mission Area: Defense System Cost

Effectiveness/Improvement, #473

Title: Productivity, Reliability, Availability
and Maintainability (PRAM)

Budget Activity: Defense-wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Department of Defense Consolidated Guidance for FY 1981-1985 highlights the fact that "our tactical Air Forces represent the most expensive investment among our general purpose forces. Procurement and operating costs continue to rise steadily, more rapidly than defense spending as a whole, even after adjusting for inflation." The guidance further expresses "deep concern about the future impact of these trends on the size, age, and readiness of the force." And calls for "major initiatives to reverse these disturbing trends and to provide an effective combat capability commensurate with our increasing commitment of resources." The PRAM program is filling this urgent requirement to reduce the rising cost of ownership while improving the operational readiness of our in-service weapon systems. PRAM's judicious and timely investment in projects lead to lower life cycle costs. These improvement projects drive the very same parameters (e.g., productivity, reliability, availability and maintainability) that lead also to improved operational readiness. This program attacks the high cost of doing business by focusing management attention and funds in a concentrated effort to reduce operational and support costs without sacrificing systems effectiveness. The program objective is pursued through investments in cost reduction projects. These projects are to: (1) improve the reliability and maintainability of weapon systems through modifications and parts substitution, (2) improve the efficiency and productivity of maintenance and logistic support organizations at all levels through improve procedures and documentation, (3) exploit lower life cycle cost alternatives in systems configurations through component commonality and use of current technology lower cost components, (4) improve specifications, standards, test methods and techniques, and (5) enhance the operational readiness of our deployed systems. Implementation of these projects lead to: reduced support manpower requirements; lower spares consumption, stock levels and storage/transportation costs; improved force readiness; and, fuel conservation through improved equipment and techniques. The need for PRAM projects for operational systems stems from the fact that technology advances through several cycles during the single lifetime of many of our systems. Successful prototypes or studies are not implemented by PRAM, but are implemented by procedural changes and preferred spares, or through the Air Force Modification Program.

(U) To manage this program, an office has been established which is managed by personnel experienced in the research and development, acquisition, and logistic support disciplines. This is a Joint Logistic Command and Systems Command Office, equally responsible and responsive to the two commanders. As such, the program office is able to cut across traditional functional and organizational lines to accomplish its goals. This office operates an integrating leadership organization, achieving its objectives primarily through interaction with Air Force Laboratories, System Program Offices, Air Logistics Centers, Major Commands and industry.

(U) PRAM provides the front-end risk reduction, investigation, prototyping evaluation of improvement projects geared toward in-service weapon systems. These projects lead to improved hardware, specifications, standards, test methods, and adaptation of commercially available items to lower in-service weapon system/sub-system life cycle costs. PRAM funds will not be used to develop new systems or to augment the funding of other development programs. Completed projects are subjected to audit during the amortization period to verify savings.

(U) RELATED ACTIVITIES: This program is related to Program Element (PE) 64212F, Aircraft Equipment Development (AED), which has as one of its goals the reduction of weapon system ownership costs through development of aircraft equipment with minimum life cycle cost. The PRAM and AED programs are complementary with AED basically funding development of end items of equipment and PRAM primarily funding adaptations of: (1) high reliability, current technology to older systems, (2) adaptation of commercial items and procedures to military applications, and (3) improvements in development and acquisition techniques, methods and specifications.

Program Element: #78026F

DoD Mission Area: Defense System Cost

Effectiveness/Improvement, #473

Title: Productivity, Reliability, Availability
and Maintainability (PRAM)

Budget Activity: Defense-wide Mission Support, #6

(U) PRAM plays a complementary role with the aircraft engine Component Improvement Program (CIP). The CIP is concerned with performance growth in specific current operational engines. PRAM's role deals with efforts applicable to several engines that improve reliability of lower engine life cycle costs. To ensure their complementary operation, PRAM propulsion projects are closely coordinated with the Air Force Propulsion Lab and the Aeronautical Systems Division's Propulsion Program Office. A dialogue has been established with the Army and Navy through which program activities and accomplishments are being exchanged.

(U) WORK PERFORMED BY: The PRAM Program Office is located at Wright-Patterson AFB, OH. Satellite PRAM offices have been established at each of the five Air Force Air Logistic Centers and at the Aerospace Guidance and Metrology Center in Newark, OH. The Air Force Flight Dynamics, Avionics, Materials and Propulsion Laboratories, as well as the Air Force Flight Test Center, Aeronautical System Division, and the Space Division, have been participants in PRAM projects.

The ten largest PRAM contractors were: Hughes Aircraft, Canoga Park, CA; Bendix Corp., Teterboro, NY; Technology/Scientific Services, Inc., Dayton, OH; Hewlett-Packard, San Antonio, TX; General Dynamics, Fort Worth, TX; Rockwell Autonetics, University of Dayton, Dayton, OH. In FY 1980 there were 78 additional contractors for a total of 93 separate contracts.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: The PRAM Program Office was formed in August 1975. As of September 1980, PRAM had initiated 444 projects representing a cumulative PRAM investment of \$49.5 million of an estimated Program net savings (gross savings less all government costs), five years after implementation, of \$927.0 million. These projects were in the areas of airframes, avionics, propulsion, missiles and space, depot maintenance, and other support areas. A total of 301 projects have been completed with a combined five-year net savings of \$380.2 million for a PRAM investment of \$19.7 million. An example of a PRAM project that will reduce operations and support costs, as well as enhance operational readiness, is the F-4 Avionics Test Equipment Improvement effort undertaken at Ogden Air Logistics Center. The current Automatic Test Equipment (ATE) for the F-4 is of obsolete mid-sixties technology, badly worn, and unreliable. This has resulted in excessive ATE downtime during depot production testing, with resulting increased aircraft flow time. The PRAM effort transitions current technology commercial equipment to replace the outdated equipment, thereby improving the reliability of the ATE, and improving the turn around time and sortie regeneration. The \$8.3 million savings projected for this effort come from increased productivity. Another project with significant savings and readiness impact is the OO-ALC effort to reduce memory unit motor failures on the Minuteman II and III Missile weapon systems. Several memory units have been extensively damaged due to continued high voltage during motor start-up. This project will ensure built-in motor protection circuitry and additionally will increase the test capability of the Memory Controlled Group test software to perform extensive diagnosis. The five-year savings to this project exceed \$2.6 million, due to reduced memory unit motor failures and the ability to fault isolate down to the lowest replaceable unit. Some PRAM projects significantly enhance productivity, while ensuring mission support. The Air Force annually requires repair and calibration of approximately 460 of its 1800 signal generators, which are used to repair and test avionics equipment. These repair and calibration procedures are currently performed manually, requiring approximately 24 hours per signal generator. Repair was previously accomplished by the Navy, which can no longer support the Air Force requirement. A \$135 thousand PRAM project prototype and tested a state-of-the-art test station, using commercially available components,

Program Element: #78026F

DoD Mission Area: Defense System Cost

Effectiveness/Improvement, #473

Title: Productivity, Reliability, Availability
and Maintainability (PRAM)

Budget Activity: Defense-wide Mission Support, #6

to perform all trouble-shooting and calibration functions automatically. To date, more than 180 signal generators have been repaired and calibrated, at an average time of only eight hours. Annual savings will exceed \$500 thousand. Another example of PRAM achieving economy while enhancing system support is a project involving the B-52 hydraulic turbopump. The turbopump, designed in the 1950's provides the primary hydraulic pressure for flight controls, landing gear, bomb bays and air refueling systems. The turbopump is currently experiencing a rapidly decreasing service life due to Technical Order changes, and changed in contractor and field level operations. This PRAM project will review and analyze the turbopump overhaul and test Technical Orders the maintenance and troubleshooting procedures, wear tolerances and hardware reliability. From this analysis and the subsequent improvements, a minimum of a 15% increase in service life is anticipated. The \$90 thousand investment is expected to yield five-year net savings of over \$500 thousand.

2. (U) FY 1981 Program: The \$8.7 million program represents a healthy trend to restore this vital program to a viable funding level. In the functional areas addressed by PRAM (i.e., airframes, avionics, missiles and space, propulsion depot and other support areas), advances in technology accelerate through several generations during the single operational life span of most of our older weapon systems. PRAM will continue to harness newer technology and transition it to our older in-service systems to lower our cost of ownership. In addition, PRAM will continue to place great emphasis on support of urgent Air Force initiatives that are within its Charter. In this regard, PRAM has undertaken projects that will provide significant fuel savings or mobility enhancement. One project with significant fuel savings is an effort to increase the fuel efficiency of the A/M32A Gas Turbine Generator Set ground cart. This cart, it its present configuration uses about 40 gallons of JP-4 fuel an hour. Fuel efficiency will be achieved by "recuperation" -- a process which captures some of the heat of the exhaust gases to warm the incoming combustion air. This reduces the required fuel to power the turbine. This effort will also increase the reliability of the 400 ground carts to be modified five-year savings, based on 1979 fuel prices, are expected to be \$20 million. Another project with both significant fuel savings and operational readiness impact is a PRAM effort to prototype an automatic anti-icing system in the B-52 aircraft. Current flight procedures calls for anti-icing action whenever a possibility of icing exists, whether or not actual icing is encountered. This entails increasing thrust, and using speed brakes to maintain the flight schedule. This increases fuel consumption by up to 50%. This PRAM project will test a system, now used on the F-111, to activate the deicing system automatically when icing actually occurs. The potential increased range offered by this system can be used to enhance mission profiles. The fuel savings projected exceed \$40 million annually. As regards mobility, PRAM has initiate a project to significantly increase the Air Force ability to move mobility kits. The present mobility bins were designed for the B-29 aircraft and waste approximately 35% of the available space of the 463L pallet system in use on modern USAF cargo aircraft. The PRAM study will prototype mobility bins that can utilize 30% more of the existing capacity of the cargo aircraft. The fuel savings projected exceed \$40 million annually.

3. (U) FY 1982 Planned Program: In our efforts to restore PRAM to at least a fraction of its' 1977 \$31.5 million funding level, the FY 1982 \$9.5 million request represents a minimum viable level for an effective PRAM Program. This projection of steady program growth is essential to maintain the interest and participation of the Air Logistics Centers

Program Element: #78026F

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Accordingly, PRAM will apply maximum management attention to improve the operational readiness and to lower our cost of ownership of our older in-service systems. Candidate PRAM projects exceeding the budget request have been compiled. As in the past, projects actually pursued will be those offering the best potential return on investment.

4. (U) FY 1983 Planned Program: Specific investments will be similar to and in some cases continuation of those initiated in the previous year. The planned \$10,000 thousand request underscores the Air Force commitment to focus management attention and funds in a concentrated effort to enhance productivity, reduce life cycle costs and improve operational readiness of in-service systems! Completed projects will continue to stand audit during the armorization period to verify savings.

5. (U) Program to Completion: This is a continuing program.

6. (U) Milestones: Not Applicable.

FY 1982 RDT&E DESCRIPTIVE SUMMARY

Program Element: #01004F

Title: International Military Headquarters and Agencies

DOD Mission Area: International Cooperative RDT&E, #460

Budget Activity: Defense-Wide Mission Support, #6

(U) RESOURCES (PROJECT LISTING)(\$ in thousands):

Project Number	Title	FY 1980 Actual	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Estimated Costs	Not Applicable
TOTAL FOR PROGRAM ELEMENT								
2447	SHAPE Technical Centre/	2,120	1,980	2,600	2,700	Continuing	Not	Applicable
	AGARD/Co-op R&D		1,720	2,280	2,360			
2446	Von Karman Institute		260	320	340			

(U) BRIEF DESCRIPTION OF ELEMENT AND MISSION NEED: This program satisfies Department of Defense (DOD) administrative agent responsibilities for the North Atlantic Treaty Organization (NATO) Advisory Group for Aerospace Research and Development (AGARD) in Paris, France and for the Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) in The Hague, Netherlands, pays for United States scientists at STC, supports United States Air Force participation in cooperative research and development (R&D) agencies and groups, and pays the United States share of NATO support von Karman Institute in Brussels, Belgium.

(U) BASIS FOR FY 1982 RDT&E REQUEST: Support of this program is a continuing international commitment under the of NATO and our mutual weapons development agreements with our allies. Includes funds for improving cooperation NATO member nations in aerospace R&D under ACARD, for paying civilian salaries at STC, for international cooperation R&D, and for the von Karman Institute. The cost estimates were determined from past experiences plus anticipated inflation/exchange rates.

(U) COMPARISON WITH FY 1981 DESCRIPTIVE SUMMARY:

	FY 1980	FY 1981 Estimate	FY 1982 Estimate	FY 1983 Estimate	Additional to Completion	Total Estimated Costs	Not Applicable
RDT&E	1,900	1,978	1,978		Continuing		

(U) OTHER APPROPRIATION FUNDS: Not Applicable

1333

Program Element: #01004F

DOD Mission Area: International Cooperative RDT&E, #460

Title: International Military Headquarters and Agencies
Budget Activity: Defense-Wide Mission Support, #6

(U) DETAILED BACKGROUND AND DESCRIPTION: The Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre (STC) is a multinational organization responsible directly to the Supreme Allied Commander, Europe. The Centre provides scientific and technical advice on military problems with emphasis on Command, Control and Communications. The United States Air Force (USAF), as administrative agent, supports 22 of 106 international scientist and engineer positions at STC. These salary expenses are reimbursed at North Atlantic Treaty Organization (NATO) rates thru credits to our NATO account. (Since the United States (US) pays less than NATO for an equivalent position, the US receives more credit than is actually spent.) The Advisory Group for Aerospace Research and Development (AGARD) provides technical advice and assistance to the NATO Military Committee, promotes advances and cooperation in the aerospace sciences, and provides assistance to requesting NATO member nations to help increase their aerospace scientific and technical potential. The USAF is also administrative agent for AGARD and funds for non-government as well as USAF participation in the AGARD scientific and technical meetings. This includes contracting for special services such as language translation for meetings in the US. In addition to AGARD-sponsored cooperative Research & Development (R&D) efforts, this program pays for USAF participation in data exchange and engineer exchange agreements with free world countries, and participation in those NATO agencies and groups in which USAF membership and participation is directed by treaty or other agreement. Examples of the latter include the NATO Air Force Armaments Group, eight subordinate subgroups and the Tri-Service Groups on Air Defense and on Communications and Electronic Equipment. The remaining international responsibility is for the US share (12.5%) of NATO support to the von Karman Institute for Fluid Dynamics in Brussels, Belgium. This world class international research facility is instrumental in advancing the state of the art in fluid dynamics and related disciplines. Thru research contracts and publications it is partially self sufficient; remaining budget requirements are contributed by the NATO nations.

(U) RELATED ACTIVITIES: Supports international cooperative R&D agreements, Information Exchange Projects, the US Mutual Weapons Development Data Exchange Program, The Technical Cooperation Program with the United Kingdom, Canada, Australia, and New Zealand, the Defense Research Group, and the US Air Senior National Representative to the Under Secretary of Defense for Research and Engineering.

(U) WORK PERFORMED BY: Leading US civilian and military scientists, engineers, and administrators.

(U) PROGRAM ACCOMPLISHMENTS AND FUTURE PROGRAMS:

1. (U) FY 1980 and Prior Accomplishments: Completion of Project 2000, a NATO military committee-directed technology forecast of the military capability of NATO in the year 2000. Trials of an information display system for command and control installed at SHAPE for evaluation. Cooperative R&D accomplishments include: signing of a Memorandum of Understanding (MOU) by France (FR), Germany (GE), the United Kingdom (UK) and the United States for the development of a Family of Air-to-Air Missile Systems; signing of an MOU with FR and GE for the shared development and use of an electronic warfare tactics facility in Europe; US participation in very successful chaff trials with the UK, FR and the Netherlands; signing of a joint US/GE agreement for development of the LOCUST Mini Drone (fifty-fifty cost sharing);

Program Element: #01004F

DOD Mission Area: International Cooperative RDT&E, #460

Title: International Military Headquarters and Agency
Budget Activity: Defense-Wide Mission Support, #6

implementation of a plan for greater cooperation with Korea in R&D and production; and scientist exchange programs with Germany and Korea. While some of the data exchange and cooperative R&D initiatives do not produce expected results, the relatively small investment and the growing technical capabilities of our allies make this program one of the most highly leveraged in the RDT&E Appropriation.

2. (U) FY 1981 Program: Emphasis on Electronic Warfare and Command and Control systems by the Supreme Headquarters Allied Powers Europe (SHAPE) Technical Centre including information systems for command and control, verification and further development of the Air Command & Control System concept proposed by the Air Defence Planning Group, and planning and implementation support for the NATO Integrated Communications System, which is to be the backbone of survivable, secure communications for NATO. Continued support for the NATO Advisory Group for Aerospace Research and Development and the von Karman Institute. Meeting US treaty obligations through participation in NATO working groups and conferences. Efforts will continue towards reaching agreements on other Family of Weapons concepts, conclusion of the Agreement with the UK on the purchase of the Rapier Air Defense Missile, and initiation of a data exchange agreement between the US and Spain.

3. (U) FY 1982 Planned Program: Participation in NATO working groups will continue as well as cooperative research and development efforts. Funding increases are the result of civilian pay raises, the addition of civilians at STC, small additional support for AGARD and the von Karman Institute, and programming of funds to pay the salary of the next AGARD Director, who is expected to be a US citizen. Actual fund requirements will fluctuate with the overseas value of the dollar.

4. (U) FY 1983 Planned Program: The efforts described above will continue.

5. (U) Program to Completion: The US AGARD Director is expected to serve for three years. The other efforts described above are part of a continuing program.

6. (U) Milestones: Not Applicable

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